American Machinist
Volume 58 NEW YORK, APRIL 19, 1923 Number 16

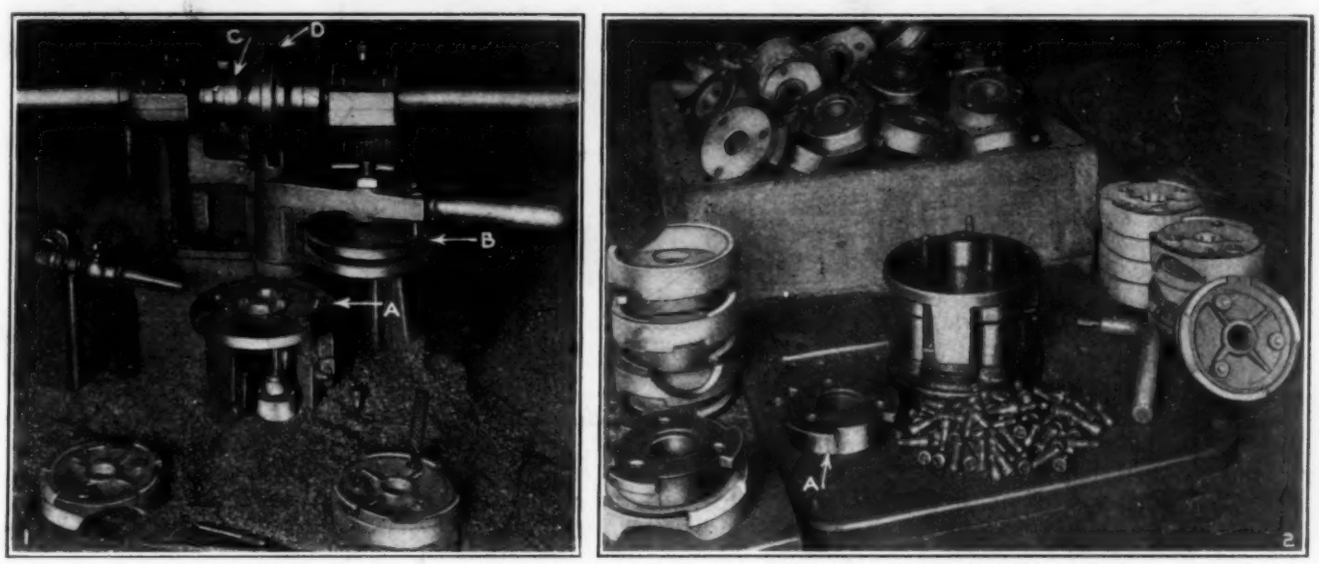


FIG. 1—TAPPING FOR CHUCKING PLATE. FIG. 2—FASTENING ON CHUCKING PLATES

Special Methods in Water Meter Manufacture

BY FRED H. COLVIN
Editor, *American Machinist*

A novel method of chucking work — Use of balls for locating and gaging—Milling and slotting fixtures for handling difficult work

THE METHODS about to be described have many features which can be adapted to other uses, and in addition, have not only greatly reduced manufacturing costs but have secured such a uniformity of product that the percentage of meters which do not pass the final inspection tests is so small as to be almost negligible. These methods are from the plant of the Neptune Meter Company, Long Island City, N Y., and are due to works manager Ricketts and master mechanic Mathus, together with an able corps of assistants. The originality displayed in developing these methods will speak for itself.

Beginning with the case, which contains the measuring or ball and disk diaphragm, we find a number of original methods. This case is in halves, each half being a brass casting as shown in Fig. 1. The castings were originally machined on a hand screw machine or turret lathe in the usual manner and some very interesting tools were used in the process. The hand machines have, however, given way to a battery of automatics.

In order to secure rapid and accurate handling of the automatics a system of chucking was devised which aided greatly in the processes which follow. The chucking system consists of securing each casting to a hardened steel chucking plate by which it can be quickly and accurately chucked in any machine of the series while the various operations are being performed. Some of the chucking plates are shown in Fig. 2. They are very carefully made and enough are provided so that a chucking plate remains with the piece until it is finished.

The chucking plates are fastened to the castings by the hollow head cap screws shown in Fig. 2. The castings, however, pass through a series of preliminary operations to prepare them for the chucking plates. A series of small, special machines face the three bosses, drill and tap holes in them for the cap screws, so that the chucking plates can be screwed on quickly and squarely by the little machine shown in Fig. 2.

One of the special machines, the one which taps the holes, is shown in Fig. 1. The segment *A* locates the

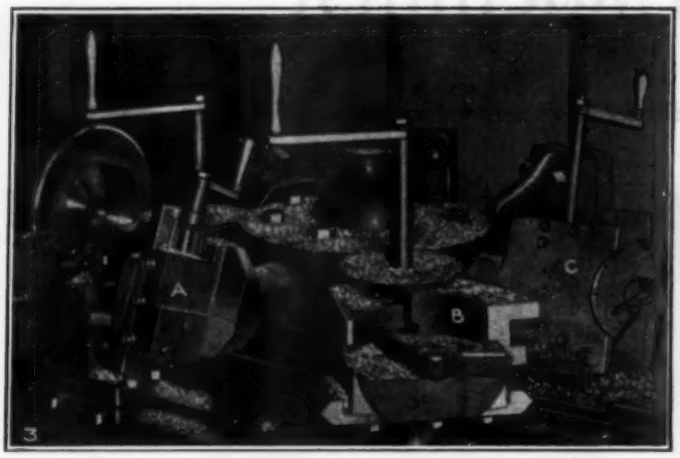


FIG. 3—TURRET LATHE METHOD OF MACHINING.

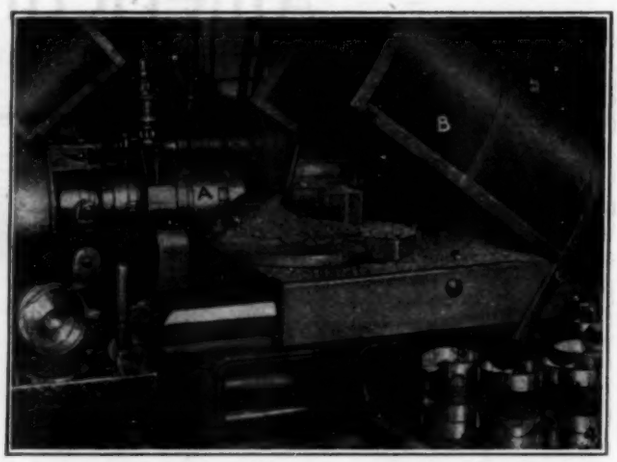


FIG. 4—ONE OF THE BATTERY OF AUTOMATICS

casting between openings in the side of the case, the openings being so spaced as to make it impossible to get the piece on in a wrong position. The castings are held by the plate *B* which swings over the work head containing the spindles and is so conveniently arranged that the work can be handled very quickly. Swinging the handle so as to cover the work, throws the jaw clutch *C* to the right and engages the clutch on the cam *D*. The cam feeds the work down to the cutters, drills or taps. When the cam has reached the lower limit it trips a small bell crank and releases the clutch. An air jet at the side clears the table of chips and avoids trouble from that source.

The castings then go to the machine in Fig. 2, which has three spindles equipped with friction driving heads. A screw is placed on each spindle, a chucking plate *A* placed over the screws, a casting with the holes already tapped goes over the chucking plate and a few turns of the spindle tighten the plate in place and the piece is ready to go on its way through the various operations. The chucking plates have three segmental projections which fit into the chucks on the lathes, a partial turn locking them under corresponding lugs as with a bayonet joint. Air pressure then draws the chuck back into position and locks it for the machining operations.

The cases were originally machined on turret lathes with the aid of very interesting tooling equipment. Some of the product is still made in this way, as shown in Fig. 3, which is a study in special turret tools. Four of the tools have movements independent of the turret slide which simply places them in position for cutting. Tool head *A* has a slide movement, operated by the crank shown which faces the angular surface inside case. Tools *B* and *C* rough and finish the ball seat in the center. The roughing tool, *B*, is moved by a pinion and gear segment while the finishing tool *C*, is given a smoother action by means of a worm and gear. These machines are being replaced by automatics.

Newer Methods on Special Machines

Machining the case consists of boring the inside of one half to certain definite shapes, turning a ball center, recessing for matching the other half, and turning the outsides of both halves together to a predetermined taper. Each operation is performed on a separate machine, the piece traveling progressively from one operation to the next. The automatic machine shown in Fig. 4 only turns the ball center, but is typical of the machines for the other operations. This view shows how the work is held in the chuck by means of the chucking plate at *A*, and it will be noted that every piece has a plate attached as previously stated.

The chip screen *B* is automatically lowered over the work as the tool slide travels forward, effectually preventing the flying of chips. When the slide reaches the proper position the ball seat turning-tool comes into operation and swings around so as to form the ball seat with a single pointed tool. After turning the ball seat the slide travels back, the screen rises, and the operator takes out the finished piece and puts in a new one.

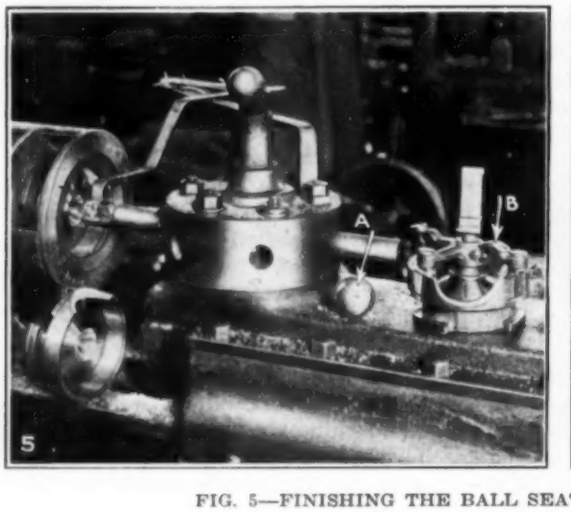


FIG. 5—FINISHING THE BALL SEAT.

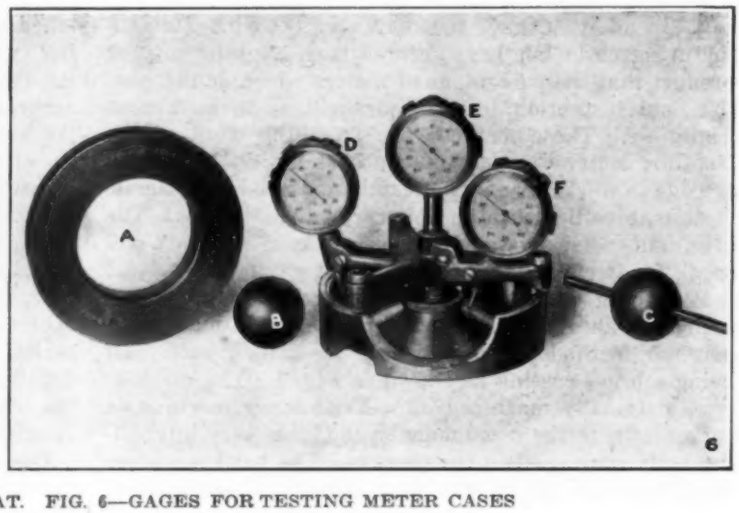
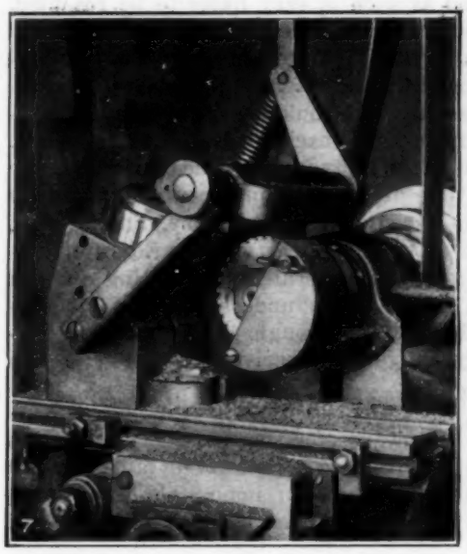


FIG. 6—GAGES FOR TESTING METER CASES



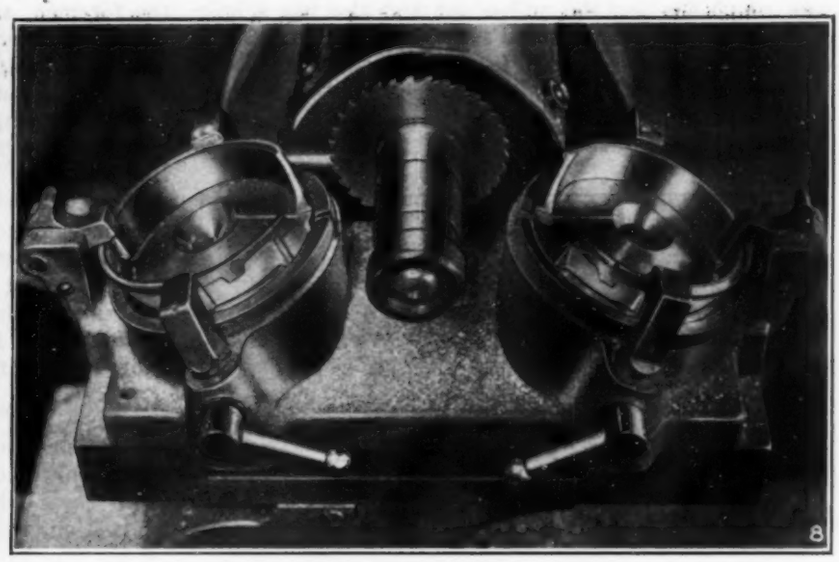


FIG. 7—CUTTING SLOT FOR DIAPHRAGM. FIG. 8—ANOTHER METHOD OF CUTTING SLOT

When the line-up is completed there will be a battery of machines both for roughing and for finishing each operation.

The final method of finishing the ball seat is shown in Fig. 5. Here an ordinary turret lathe is used and a swinging tool head, carrying a single point tool is used as shown. This view also gives a very good idea of the appearance of the finished piece as well as one of the

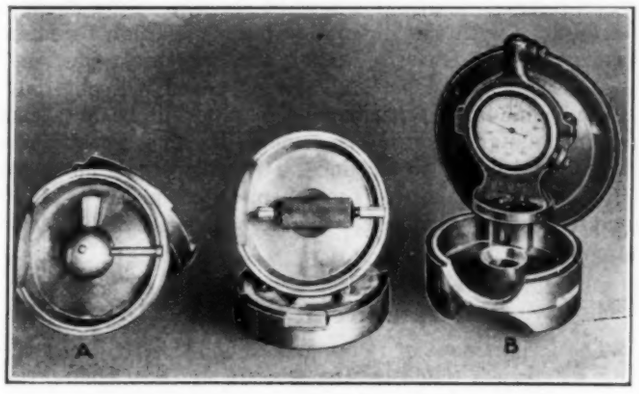


FIG. 9—SOME OF THE GAGES USED

gaging methods used. The ball seat is gaged by a standard steel ball, as at *A*. In fact balls are used in a number of different ways in connection with machining the case. Another gage, shown at *B* has a half ball in the center and three arms which gage the height of the ball sockets to the shoulder.

This gage is shown in detail in Fig. 6, together with a diameter gage in the form of a hollow plug at *A* and two balls at *B* and *C*. The ball *B* tests the ball seat only, while the rod in ball *C* tests the slot which is cut later with reference to the seat. The three Ames dial gages test the relation of the various surfaces. The three arms have hardened plugs which rest in the recess on the edge. The pointer on gage *D* rests on the inclined surface near the outer edge, while one on gage *F* touches it near the top. These gages test the angle of incline as well as its relation to the recess. Gage *E* has a half ball on the end and tests the relation of the ball seat to the recess and to the inclined surface.

The chamber formed in the cases is divided into two parts by means of a thin diaphragm made of sheet metal. Two methods of cutting the diaphragm slot are shown in Figs. 7 and 8. The first shows the slot being cut in half of one case at a time while, in the other, the slot is cut in both the upper and lower halves at the same setting. In the first method the half case is held upside down and the cut is made from below while in the second method the work passes under the cutters, first in one direction and then in the other. The method of clamping the pieces enables the workman to see just what he is doing.

Another and much more difficult slotting operation is done on a special machine, not shown, the slot being radial with the ball center. The gages used are shown in Fig. 9. The gage in the center inspects the width of the slot and is simply a "go" and "no go" plug. The gage *A*, however, inspects the angle of bottom of the case and the arc of the slot just cut. The ball of the gage fits into the center, the long projection fits the milled slot and the short tapered piece gages the bottom. The dial gage at *B* checks the depth of the slot at the edge.

The cases fit into an outer body with a slight taper, and the next step is to assemble them in pairs. Before doing this however, the inside is burred by a revolving cutter which has replaced hand work on this operation. The two halves are then put together with a ball in the center as shown at *A*, Fig. 10. The ball *B* carries an

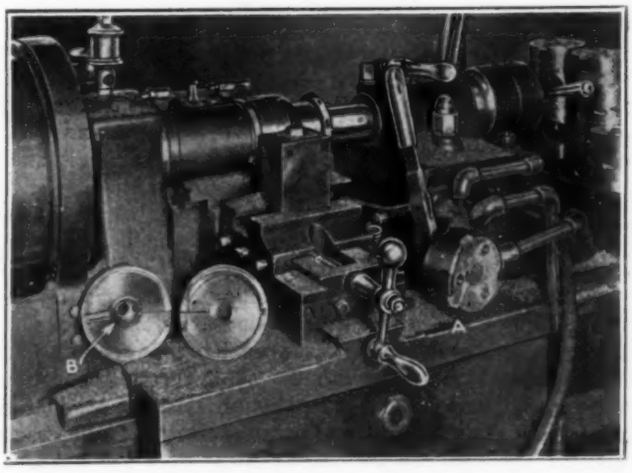


FIG. 10—TURNING TAPERS ON CASES

arm which fits into the milled slot and also has a hole through the center, as can be seen by close examination.

The hole fits over a stud in the chuck which insures the pieces being held centrally and the arm on the ball holds the two pieces in correct relation while the outside is being turned taper. The taper is controlled by a

FIG. 11—GAGE AND CENTERING DEVICE

guide at the back but every case is tested in the ring gage shown at *A*, Fig. 11. This figure also shows the centering and locating ball more distinctly than Fig. 10. The taper ring gage at *A*, Fig. 11, is a limit gage, the opening at *B* showing the tolerance which can be permitted.

The Foreman and the Suggestion Box

BY FREDERICK A. POPE

Many articles describing suggestion-box plans and the results obtained from them have appeared in various journals during the past few years; and it has been observed that, while in many cases such plans have been for a time successful, interest in them has not been permanently sustained.

It is, of course, a fact that even though the executive staff is thoroughly efficient from the manager down, there are always a great many small problems connected with the various divisions of any plant's activities, which problems, though individually of minor importance, in the aggregate may seriously affect the final performance of the plant as a whole. Many of these opportunities for small improvements must necessarily escape the attention of the executive staff; and it is just these little things that the man on the job can, if he is properly encouraged, bring to the attention of his superiors for possible improvement.

IMPORTANCE OF THE FOREMAN

We have all heard complaints from machine operators and other employees that suggestions for small improvements made by them are not encouraged by department foremen, and perhaps not even kindly received in some cases. It is, of course, for just such cases that the secret suggestion box is designed. While the box will collect many a "knock" and "whine," they can be overlooked when we consider the constructive suggestions received.

There is, however, another side to the use of the suggestion box for getting co-operation and developing the confidence of employees in the management, that I have never seen pointed out. Whatever its theoretical advantages may be and even though actually productive for a time, the suggestion box seems to me to be essentially a short-cut to the management over the heads of the foremen, and as such is very likely to be resented, even though not openly, by the latter.

It is my opinion that if there is to be made any real organized attempt to encourage and develop suggestions from employees, it should be done through foremen and department heads exclusively, and done openly. Blank forms, if desired, especially designed for the convenient writing of suggestions, can be placed in foremen's hands throughout the factory, and in that way made readily available at all times. Educate foremen to extend every possible aid in preparing an idea for submission, and have it understood that all suggestions must be passed through to the judges. Acknowledge every suggestion received.

REMOVE SECRECY FROM THE PLAN

The question of rewards for successful ideas involves no difficulties of solution—it is one of detail only. In those cases where it has been impossible to adopt a suggestion, the employee can at least be made to feel by his foreman that his efforts have been appreciated, but to accomplish this the foreman must be in the worker's confidence.

In order to obtain the results all around that the suggestion box is intended to accomplish the big essential is, in my opinion, to remove the secrecy and make the whole plan wide open. In other words, a permanent *esprit de corps* can be developed only by first selling the idea to shop foremen and other department heads, first of all developing in them the proper spirit of co-operation with the management and then one of whole-hearted helpfulness toward the men under them.

Do away with the suggestion box, depend on foremen to develop and encourage their men to think and suggest. If this is done, suggestions boxes will not only be superfluous, but permanent results will be obtained which no suggestion box scheme in its most prosperous days could hope to produce. On the other hand, if foremen are left out of the scheme, it is pretty certain that the suggestion box will not be operative for very long.

Manufacture of Saws, 1921

The Department of Commerce announces that, according to reports made by the Bureau of the Census, the value of products of establishments engaged primarily in the manufacture of saws amounted to $18,185,000 in 1921 as compared with $31,461,000 in 1919, and $12,517,000 in 1914, a decrease of 42 per cent from 1919 to 1921, but an increase of 45 per cent for the seven-year period 1914 to 1921. This industry includes establishments manufacturing as their product of chief value all kinds of hand and power saws.

Of the 79 establishments reporting products valued at $5,000 and over in 1921, 11 each were located in Illinois and Pennsylvania; 10 each in Massachusetts and New York; 7 each in Michigan and Ohio; 3 in Connecticut; 2 each in California, Indiana, New Jersey, Oregon, Tennessee, and Washington; 1 each in Georgia, Iowa, Kentucky, Maryland, Mississippi, Missouri, New Hampshire, and Rhode Island.

In January, the month of maximum employment, 4,672 wage earners were reported, and in July, the month of minimum employment, 3,160—the minimum representing 68 per cent of the maximum. The average number employed during 1921 was 3,788 as compared with 5,510 in 1919 and 4,560 in 1914.

Modern Electric Motor Construction

By J. M. BARR and HOWARD CAMPBELL

Recent developments in electric motor construction —Theories giving way to modern shop practice — Operations in the construction of open-slot rotors

MODERN electric motor design has been making rapid strides in recent years. Much of this progress is being made because we are finding out possibilities in certain directions and in many cases taking liberties with the old established principles of

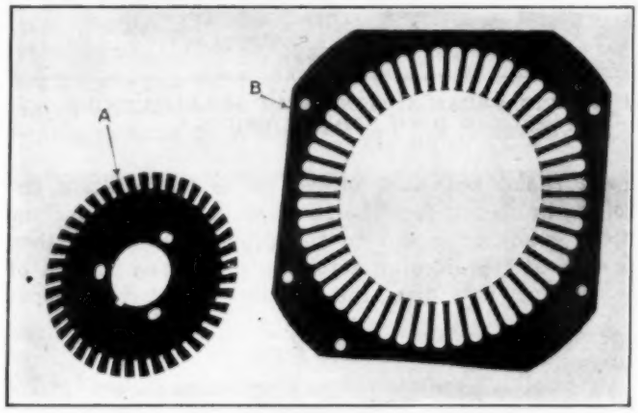


FIG. 1—*A*, ROTOR STAMPINGS. *B*, STATOR STAMPINGS

design in order to better accommodate them to economical present day manufacturing methods.

For many years it was thought that the rotor bars of an induction motor must be insulated from the core in order to eliminate wasteful currents. Accordingly these bars were thoroughly insulated at an appreciable expense. In time the insulation became brittle and gradually disintegrated, leaving the rotor bars so loose that they rattled badly in the slots. Today the majority of motors in the smaller sizes do not employ rotor bar insulation.

Again, the rivet construction as we have it today is an example of transforming questionable design to

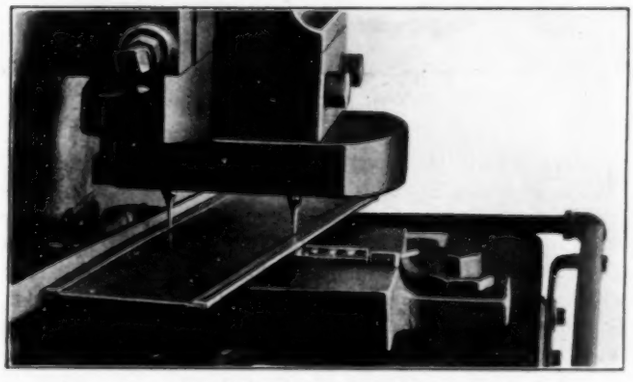


FIG. 2—PUNCHING CLEARANCE HOLES IN THE ROTOR WINDING

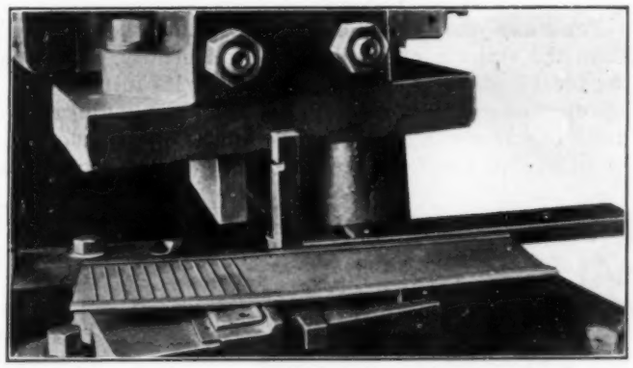


FIG. 3—SHEARING AND SEPARATING THE BARS

one of undoubted success. In the older attempts at riveted construction, rivets shouldered at both ends were used and frames were carefully machined, laminations were stacked on the rivets and then when the rivets were headed the end frames were parallel and in alignment. Unfortunately no allowance was made for the variance in the thickness of the sheet metal employed and after the rivets were headed it was generally found that the laminations were very tight on one side of the core and very loose on the other. This construction was changed from failure to success by simply omitting the shoulders from the rivets and allowing the end frames to tilt or

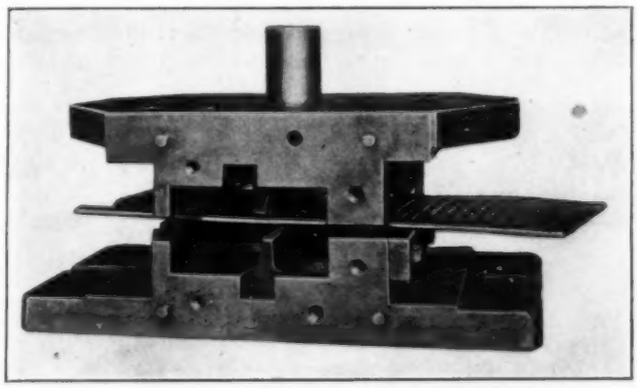


FIG. 4—DIE FOR TWISTING THE BARS

cock so as to bring about an equal pressure on all parts of the laminations. After riveting, the end frames were machined from the center of the core, which not only made a concentric bore but as both were machined at the same setting, it assured that the end plates would have parallel seats and that the bearings would be aligned.

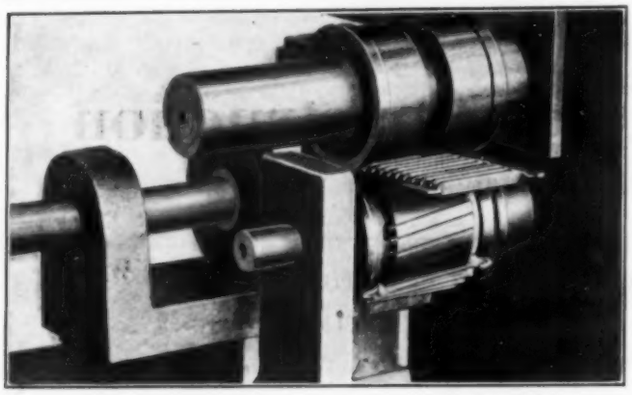


FIG. 5—ROLLING THE BARS INTO THE ROTOR SLOTS

For many years it has been realized that sheet copper, from the standpoint of electrical uniformity, would be the ideal material for rotor windings. Its introduction, however, seemed to present quite appreciable difficulties until the Louis Allis Co., Milwaukee, Wis., undertook to utilize it for that purpose. The elimination of a

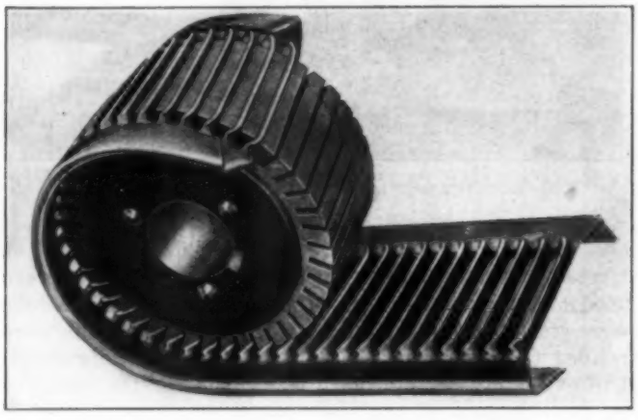


FIG. 6—HOW THE BARS FIT INTO THE SLOTS

large number of joints and the leaving of the copper in the best possible mechanical condition were the objectives. In attacking this problem, it was evident that the winding must be applied from the outside of the rotor. This at once led to the use of an open type of slot, and here again the older theory has been discredited because it has been found that by maintaining a certain ratio

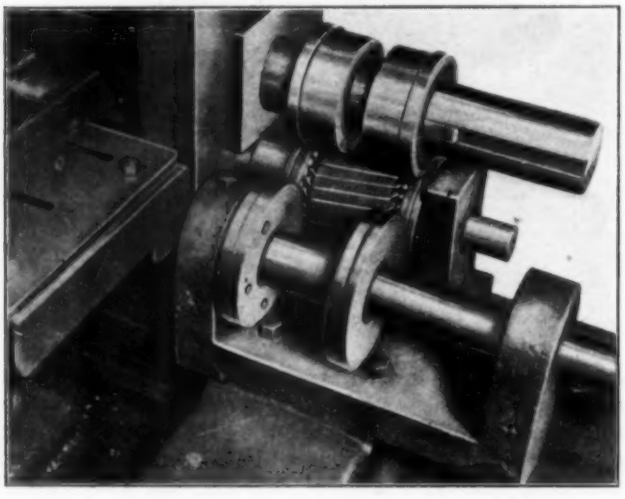


FIG. 7—MACHINE PERFORMING THE "ROLLING-IN" OPERATION

between the slot opening and the air gap, the characteristics of the motor need not suffer appreciably. The use of an open slot as shown at *A*, Fig. 1, not only permitted the winding to be introduced from the periphery of the rotor, but incidentally simplified and cheapened the construction of the dies for blanking the rotor laminations, because it eliminated much of the hand work.

In line with modern practice, the rotor bars are of necessity left uninsulated. In order to facilitate wrapping the winding into the rotor core, the slots were not

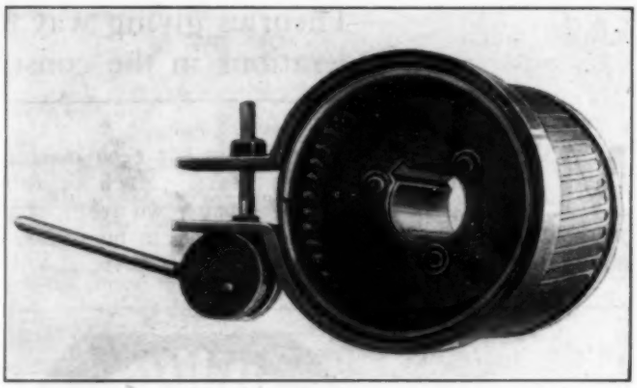


FIG. 8—CAM-ACTION CLAMP HOLDING END RING FOR SOLDERING

made radial but were off-set so as to facilitate the rolling-in operation. The sheet of copper used for the rotor windings is cut to the proper width and then seamed at the sides on a folding brake, the amount of seam depending upon the amount of end-ring copper

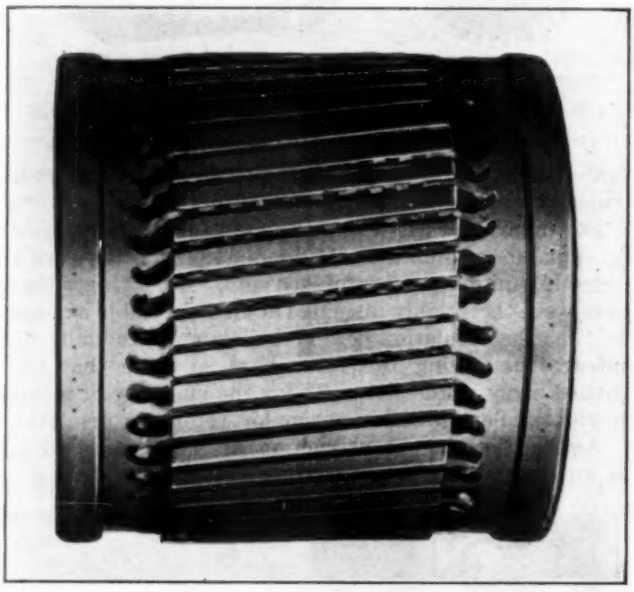


FIG. 9—ROTOR AFTER SOLDERING

required. It is then put through a piercing operation, Fig. 2, in which a series of small holes are punched the proper distance apart across the sheet and of the proper pitch to correspond with the finished rotor. These holes also constitute a clearance for the ends of the shear by which the bars are separated and given a slight twist, as shown in Fig. 3. The holes have another function in that they prevent sharp corners which might be responsible for starting cracks in the copper. By means of the forming dies shown in Fig. 4 the slotted bars are

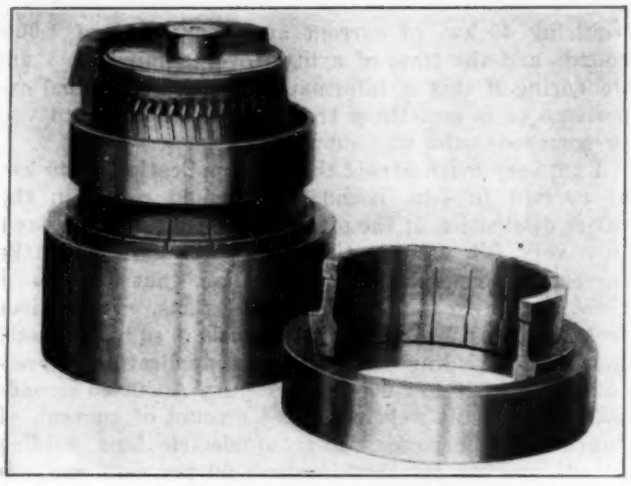


FIG. 10—VIEW SHOWING CONSTRUCTION OF CONTRACTING CHUCK

twisted to approximately the right angle of the slots. The pitch of the bars does not correspond with the final position which they will occupy in the finished rotor, but is more nearly approximate to the chordal distance of the slots at the periphery of the rotor. The copper is now ready to be fitted into the slots in the rotor, which is done by means of the rolls shown in Fig. 5.

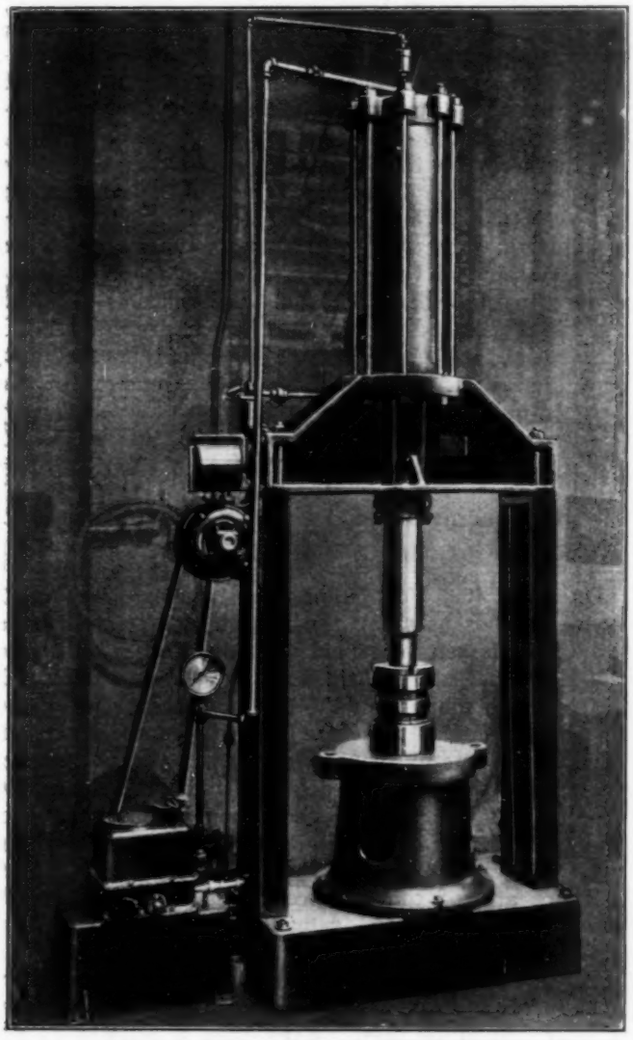


FIG. 11—OIL-GEAR PRESS COMPRESSING THE END RINGS

The first copper bar is inserted in a slot and the machine is then started, the operation of which presses each copper bar into its corresponding slot, as shown in Fig. 6. The opposite side of the machine can be seen in Fig. 7. After the copper bars have been rolled into place, the roll on the near side of the machine, Fig. 7, is exchanged for a roll that contains rows of spiral teeth corresponding with the slots in the rotor. As the rotor is revolved, these teeth force the bars into the slots and expand them so that they will fit tightly. The next operation is to hold the end rings together, using the device shown in Fig. 8, so that they can be soldered. Silver solder is used for this operation and the finished job is shown in Fig. 9.

The rotor is now placed in the contracting chuck shown in Fig. 10 and pressure is applied endwise, using

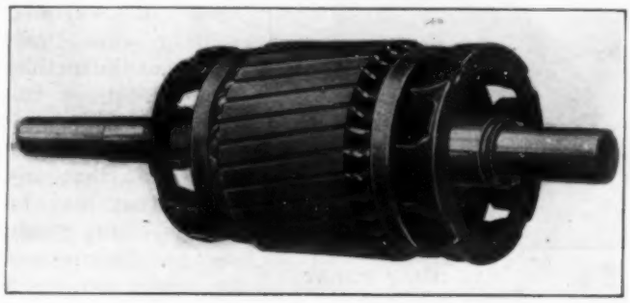


FIG. 12—ROTOR COMPLETE WITH END PLATES

the oil-gear press shown in Fig. 11. A plug is placed in the bore of the rotor and a collar is slipped over it which insures that the end rings will be concentric with the shaft. This operation compresses the metal in the end rings, making them about ten per cent smaller and carrying the bars into the bottoms of their respective slots, as can be seen by reference to Fig. 12. Compressing the copper in the end rings also hardens it.

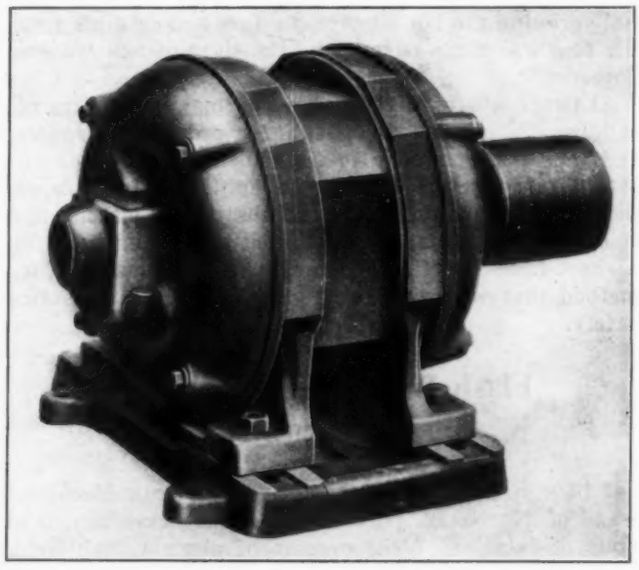


FIG. 13—COMPLETED MOTOR

A finished motor of the type in which this rotor is used is shown in Fig. 13.

The foregoing is an illustration of a somewhat radical departure from the conventional rotor construction that is indicative of the general tendency toward a reconciliation of manufacturing methods with theoretical consideration.

Warming Lubricating Oil

From *The Travellers Standard*

In cold weather it is not uncommon for the lubricating oil used on engines and other machinery to become thickened so that it flows about as slowly as the proverbial "molasses in January," and in order to use such oil with good effect it must first be warmed slightly so that it will flow freely into the oil cups. In engine rooms it is quite the usual thing to leave the oil-cans on the steam chests or in other warm places; but elsewhere in the plant it may not be so easy to keep the oil at the right temperature.

AN OIL CAN THAT BURST WHEN HEATED

Care should be used in warming cold oil-cans, and whatever the method adopted, it is important to make sure that the can is vented so that any vapor that may be evolved can freely escape. Be sure not to apply too much heat, because at high temperature combustible vapors are quite likely to be produced. Open flames should never be used for warming the oil,—not only because they furnish too intense a heat but also because the flame might ignite such vapors as happened to be generated. The importance of these points is well illustrated by an accident of which we learned quite recently. A man started to warm a can of oil over an open flame and without providing a suitable vent—the result being that the can exploded with violence, throwing the man to the ground and spraying the hot oil over his face and into his eyes. His face was badly burned and the sight of one eye was impaired.

At temperatures slightly above normal, lubricating oil will usually run freely enough for ordinary purposes, and it is not necessary to add much heat in order to obtain satisfactory results. Except in extreme cases, the oil will warm sufficiently if the can is placed on a steam pipe or radiator and allowed to remain there for a short time. Setting the can in hot water is another method that will give satisfactory results with entire safety.

Flash Welding—Discussion

By F. P. McBerty

General Manager, Federal Machine and Welder Company

I have before me a copy of the *American Machinist* issue of March 22, page 433 and have carefully read your description of the process of electric flash welding and am much interested in knowing where you secured your information on this process.

While I appreciate the fact that a great quantity of the descriptive matter is accurate, at the same time, on page 434, in the fifth paragraph on the right-hand column, you give some detailed information regarding the amount of current consumed in welding two pieces of ½-in. round stock by the butt welding process as requiring 40 kw. of current and a pressure of 1,000 pounds and the time of a little over a minute. I am wondering if this is information secured by actual experience or is something that was passed along to you by somebody who was supposed to know.

I am very much afraid that the application of 40 kw. of current to ½-in. round stock would result in the entire dissipation of the piece between the welding jaws in a very few seconds time and I think if you make correction something along this line, that you would come nearer to stating the actual facts. It requires from 16 to 20 kw. of current to weld 1 sq.in. of metal by the butt welding process and the application of pressure from 1,600 to 2,000 lb. per sq.in. About 45 seconds will make a butt weld with that amount of current. I figure that the power factor of electric butt welding on the average machine is about 50 per cent and you would therefore need from 30 to 45 kva. in welding one square inch of material. Your ½-in. round stock has about 0.2 of a square inch of cross-section and you can therefore see that the statement of 40 kw. and 1,000 lb. of pressure is a long way off from being what it should be.

My particular reason for criticising your statement is due to the fact that our specialty is the manufacture and sale of electric butt welding machines and anyone who contemplated the purchase of an electric machine with sufficient capacity to weld 1½- or 2-in. round, or even 3- or 4-in. round would, with this information, be inclined to think that it is practically a physical impossibility to secure enough current from the average public service corporation to handle the larger cross-section.

I further wish to make the statement that there is no more pressure required in making a satisfactory butt weld under the flash weld conditions than under the straight butt weld conditions as the metal has to be just as hot at the point of junction in one case as it does in the other. The only difference is that the straight butt weld heats up so much greater section of material between the welding jaws and more current flows due to the less resistance at the junction of the metal in heating the straight butt weld than is required to draw the arc between ends in making the flash weld.

From a letter addressed to A. L. De Leeuw.

Depreciation of a Lathe—Discussion

By C. J. Morrison

On page 468, Vol. 58 of the *American Machinist*, A. W. Forbes asks for the rate of depreciation on a lathe that is ten years old. If Mr. Forbes will offer the lathe for sale, he will find that the best offer will be not much more than the price of scrap represented by the lathe and therefore that its depreciation has been at the rate of about 10 per cent a year. The fact that the lathe does good work and costs little for repairs will have slight effect upon its market value, and as this value is the determining factor depreciation must be written off accordingly.

There are, of course, exceptional conditions due to the law of supply and demand which will cause machines to bring unusually high prices, but general practice extending over a long period of years shows that in order to be safe, a depreciation of 10 per cent a year should be used. Even then a concern is not always safe as absolescence may cause the depreciation to be much greater.

Automatic Grinding Machines

By ETHAN VIALL
Associate Editor, *American Machinist*

The first of two articles—Types of machines—Methods of holding and feeding work—Kinds and speeds of wheels—Stock removed and rate of production

AUTOMATIC grinding machines are a comparatively recent development in the grinding field, since it is only within the last few years that ground work has been required in sufficient quantities to warrant their design and construction.

At present, automatic grinding machines may be somewhat loosely divided into three classes: (1)—Those which take their work intermittently from a loaded magazine. (2)—Those which take their work continuously from a chute or guide. (3)—Those which, using a rotating work table, or turret, have their work placed by hand, piece by piece, in carrier receptacles or clamped into place and fed past the grinding wheel and

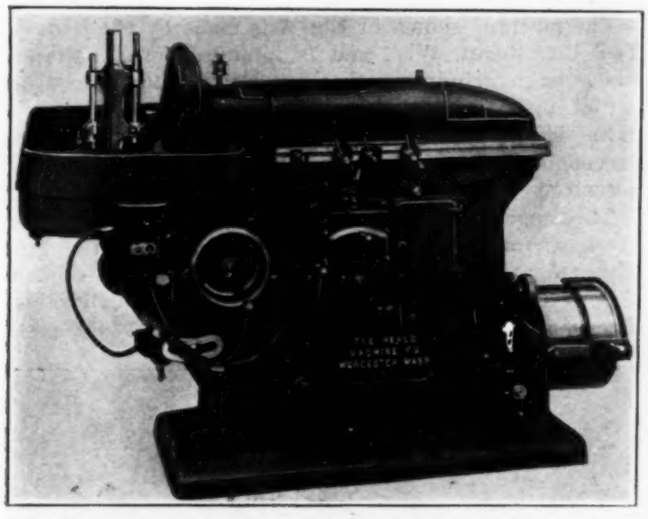


FIG. 1—HEALD AUTOMATIC PISTON RING GRINDING MACHINE

either automatically dropped out or removed by hand. In this last class, where a turret, or an oscillating holder, is used to carry the work to the wheel, the feed and grinding actions are of necessity, intermittent. In the same class of machines, where a rotating table is used it may be fitted with a carrier plate or a magnetic chuck, as the nature of the work dictates, or a combination of the two may be used. With a rotating table, the grinding action is practically continuous if the feeding conditions are right.

A good example of a truly automatic grinding machine is shown in Fig. 1. This machine is made by the Heald Machine Co., Worcester, Mass., and is known as its No. 25. A close-up view of the magazine and feeding mechanism is given in Fig. 2. As shown, the machine is fitted for finish grinding the sides of piston rings, but the sides of washers, collars, gears, or other similar work, may be done as well. The grinding wheel is carried on a slide or ram similar to that of a shaper. Movement of this slide is obtained by means of an oil operated hydraulic arrangement which can be adjusted to any required speed within its range.

The automatic feeding arrangement is made up of a feeding or carrier plate, with five holes which are bushed to take rings up to 5 in. in diameter. As the plate indexes, a ring is slid from the magazine to the center of the magnetic chuck directly under the path of the grinding wheel. The grinding wheel slide moves forward and back and the ring is ground. The feeding plate is indexed by means of a lever connected to a crank disk at the back of the machine, which is operated by a simple friction device. This crank disk is held stationary by a latch while the wheel is going forward. As the slide comes back and the grinding wheel leaves the ring the latch is tripped, allowing the crank to make one revolution which indexes the feeding plate from one hole to the next, sliding off the ring just ground and carrying a new one to the center of the chuck.

For demagnetizing the work there is a disk at the rear of the machine equipped for electrical contact with the current for magnetizing the chuck at the time the

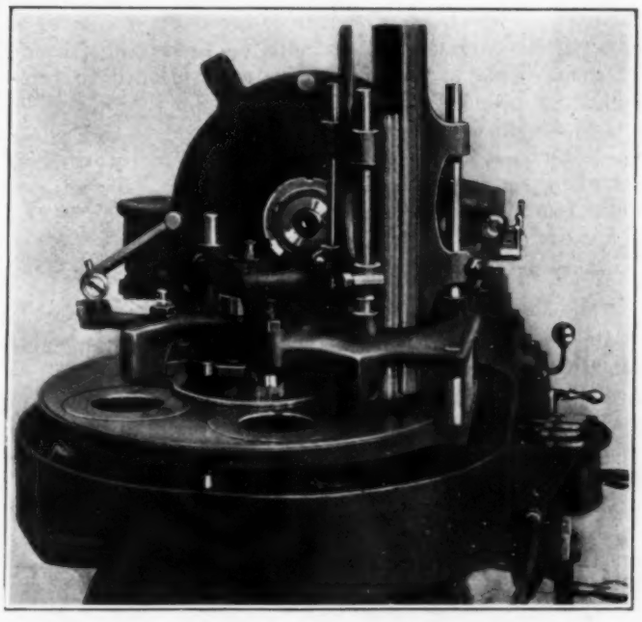


FIG. 2—CLOSE-UP OF MAGAZINE AND FEEDING MECHANISM

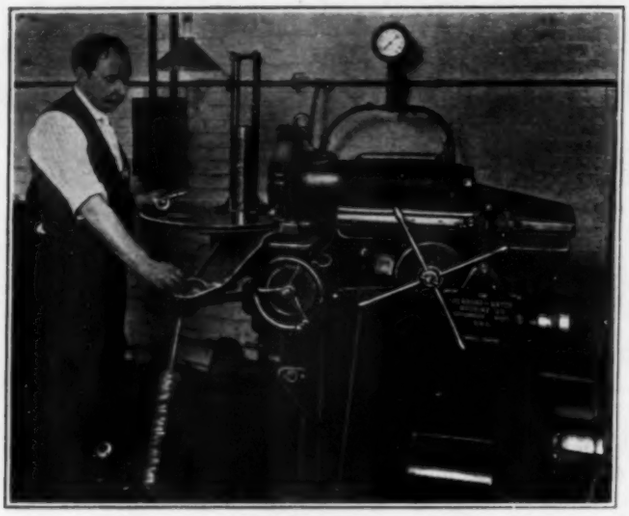


FIG. 3—PERSONS-ARTER AUTOMATIC RING-GRINDING MACHINE

ring is being ground. As the disk revolves the current is automatically shut off for an instant and reversed, thereby demagnetizing the chuck before the ring is moved. By the time the next ring has been slid in place, current of the proper direction is automatically switched on again.

A diamond for truing the wheel is located on the chuck pan and can be readily adjusted to true the wheel so as to give the desired thickness for the work. In doing this, the left hand reversing dog is thrown up, allowing the slide to go by until the reversing lever engages a safety dog. This dog is of the latch design which allows the slide to move back and forth just the right distance for truing the wheel. The wheel used on this machine is 14 in. in diameter by ¾ to 1½ in. face, and the hole is 5 in. in diameter.

A machine of the same type as the one just described is shown in Fig. 3. This machine is made by the Persons-Arter Machine Co., Worcester, Mass. In this machine the entire automatic chuck-loading, or work-carrying mechanism is rigidly attached to the work-table knee, which is raised or lowered by means of a handwheel bearing a disk graduated to thousandths of an inch. This is the only adjustment needed to compensate for wheel wear. The attachment, however, is adjustable in a vertical direction relative to the work-holding chuck by loosening two screws and rotating an elevating screw provided for the purpose. This adjustment is only made when there is great variation in the thickness of the work being handled.

Provision for Various Diameters

The vertical guide rods of the magazine are adjustable radially for various work diameters and interchangeable bushings are used in the carrier plate. These bushings are threaded into the plate and the holes are grooved to receive hardened wire rings, which can readily be replaced when worn. The work-carrier indexing mechanism is operated by compressed air. The air cylinder has a sliding D-valve operated by an adjustable rocker arm with an attached lever, worked by the reversing dogs on the wheel-slide rack at the front of the machine. This method of operation insures the action of the carrier being always in time with the stroke of the slide. Air entering the cylinder pushes the piston forward and the piston rod, which is cut as a rack, rotates the carrier plate through a gear, pawl and ratchet wheel. A spring control plunger engaging a notch in the index plate locks the carrier disk in position while the work is being ground. A check pawl is provided to prevent any back lash. Each movement of the carrier plate slides a ring from the bottom of the stack in the magazine and along a plate onto the constantly revolving magnetic chuck. The same movement slides the ring that has just been ground, off the chuck and down a chute onto a loading stem. The view shown in Fig. 4 will make clearer this explanation. In this illustration the hose leading to the air jet used to keep the magnetic chuck free from dirt is plainly shown.

Current Switched Automatically

An automatic switch turns the current into the magnetic chuck just as the grinding wheel approaches the work and turns it off as the wheel recedes. A permanently mounted diamond truing device is mounted ready for use, just back of the carrier plate.

A feature of the type of machine described is that a good operator can run several machines. A conservative estimate of the average output of such a machine may be arrived at by knowing that from 850 to 1,200 strokes per hour of the wheel slide are easily possible with a 2 in. length of stroke, which is the length used for grinding rings 4 in. in diameter. Dividing these figures by the number of operations on each ring, two, three or four as the practice may be, will give the output of finished rings.

The machine shown in Fig. 5 is made by the Badger Tool Co., Beloit, Wis., and is intended for simultaneously rough grinding both sides of individually cast or cut-off piston rings, bringing them down to approximate size preparatory to finish grinding on some high precision type of grinding machine, such as previously described.

The magazine or hopper track, used to hold the work is shown at the front of the machine near the top. This magazine holds 65 3¾ x ¼-in. ring castings, though a longer track may be used if thought advisable. The rings are backed by a pusher attached to a cable

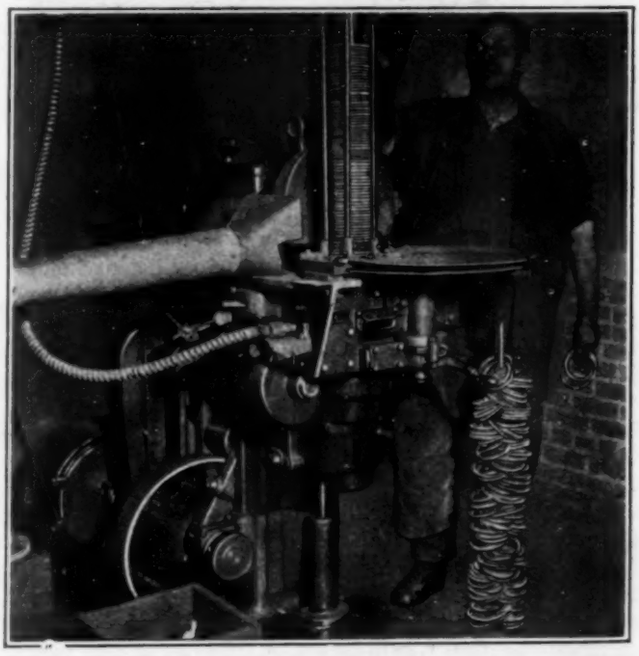


FIG. 4—FRONT VIEW OF THE PERSONS-ARTER MACHINE

and weight. A reciprocating ram, driven by a cam, arm and weight, forces one ring at a time in between the two grinding wheels. If for any reason a ring casting jams, the ram weight is simply held up and no harm is done to the mechanism. In such a case the operator draws the ram back by hand, removes the jammed ring and the machine is ready to proceed. Guide bars above and below the ring are supported at the front and back. The grinding wheels are automatically separated just as a ring enters at the front and at the same time a ground ring leaves at the back, falling into a chute and thence into a container. The ring castings are made to pass across the entire grinding face of the wheels, which are 18 in. in diameter with 7-in. center holes. The ring does not spin, but slowly turns between the wheels. In passing from front to back, the wheels close on the ring three times, which produces rings ground very flat and true. The wheels are brought towards each other and separated by a system of weights and levers

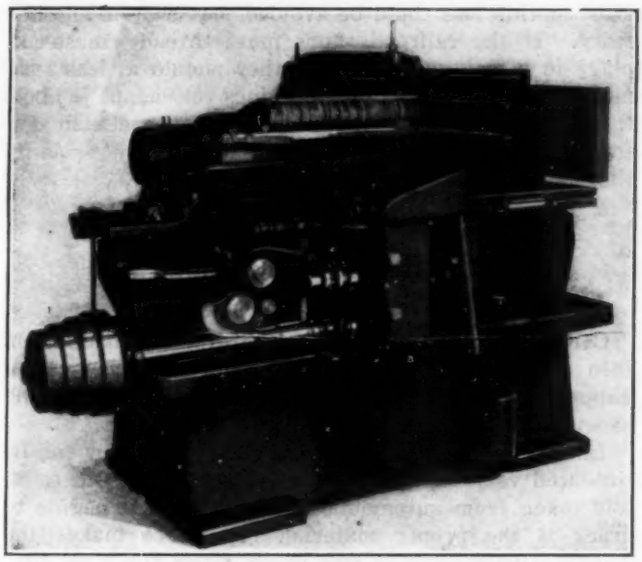


FIG. 5—THE BADGER ROUGH-GRINDING MACHINE WITH MAGAZINE

and the grinding pressure can be increased or reduced by the addition or removal of weights. A positive micrometer-stop screw is conveniently located at the front of the machine. As a general rule, adjustment is only needed about every three or four thousand rings. Of course this is largely dependent on the kind of wheel used, the hardness of the ring and amount of metal removed. Adjustments must be made after each dressing of the wheels. The wheel truing attachment is so made that the wheels may be dressed without disturbing the setting in any way.

Dry and Wet Grinding

Either dry or wet grinding is possible with this machine. In dry grinding, steel disk-wheels faced with "Diacarbo" abrasive disks are used. For wet grinding, Badger wheel-chucks carrying abrasive ring-wheels are used. The output of a machine of this type is estimated at 9,000 rings per day, and one man can attend two machines without over-exertion, giving an output of 18,000 rough-ground rings per man per day.

The same machine as just described is shown in Fig. 6, but in this case it is fitted with an oscillating work carrier instead of a magazine. It is shown ready to grind automobile door hinges. The work holder slides

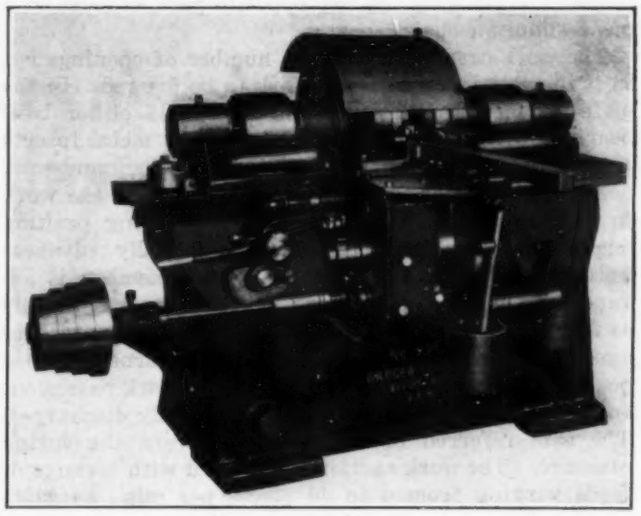


FIG. 6—THE BADGER MACHINE WITH OSCILLATING FEED

on and between hardened steel rollers, which are easily adjusted and may be set up very close. These rollers are run dry, thus preventing the accumulation of gummy masses of dirt and grit which is the case where oil is used. The work holder on the slide is arranged with clamps so that when the work is between the wheels, the piece is tightly locked in place. On the back stroke of the work slide these clamps automatically open so that the operator can instantly remove the piece and insert another. The insertion and removal of the work is all that is required of the operator, as the machine does the rest. The forward motion of the work slide is accomplished by means of weights and levers but the return is cam operated.

In the machine shown in Fig. 7, the work-feeding device and magazine are somewhat similar to those employed on the Heald and Persons-Arter machines, except that in this case the magazine is horizontal and the feeding plate is vertical. This machine, which is made by the Gardner Machine Co., Beloit, Wis., is in-

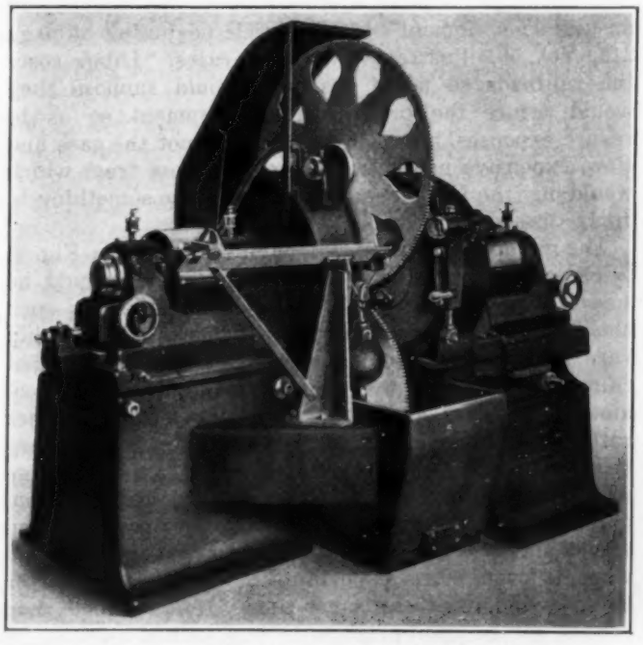


FIG. 7—THE GARDNER AUTOMATIC DOUBLE GRINDING MACHINE

tended for grinding the two opposite parallel sides of a piece simultaneously.

The work carrier plate has a number of openings cut in it in accordance with the work to be ground. In the plate shown the holes were made to hold either ball-bearing races or sad-iron sole plates, but metal inserts may be used for other shapes and sizes. The number of holes in a plate may be either five or ten. As the work in the carrier plate approaches the grinding position one of the grinding members automatically advances until it reaches a positive stop. This member is advanced under spring pressure so that it moves in only as fast as the stock is removed, giving a steady pressure against the work being ground. It is returned to open position by the action of a cam. As the work passes out from between the wheels it is automatically discharged. The cam referred to also acts to govern the spring pressure. The work carrier is provided with a range of feeds varying from 6 to 40 pieces per min., so as to accommodate various grinding conditions and sizes of work.

On hardened steel ball-races, 3 in. in diameter, using alundum ring-wheels, 0.007 in. of stock was removed at the rate of 1,008 pieces per hour. The grinding limits, plus or minus, were 0.001 in., and the limit for parallelism was 0.00025 in. On sad iron sole plates made of cast iron, with an approximate area of 20 sq.in. on each side, from 0.015 to 0.030 in, of stock was removed at the rate of from 180 to 360 pieces per hour, depending on the accuracy of the original castings. The grinding members were G. I. A. disks, and the limits, plus or minus, were 0.003 in. On small cast-iron gear blanks with an approximate side area of 17 sq.in., 0.035 in. of stock was removed at the rate of 576 per hour, using No. 166 G. I. A. disks as grinding members. The plus or minus limits were 0.002 inch.

Railroad Shop Work

BY C. J. MORRISON

The articles in the *American Machinist* on railroad shop practices often show interesting and ingenious methods of performing operations with inadequate and unsuitable equipment and the article beginning on page 213, Vol. 58, illustrates two such cases. Labor costs the railroads so much that one would suppose they would secure the best possible equipment so as to reduce expenses, but such seems to be not the case and slow, expensive methods are used, the loss from which would buy the needed equipment and leave something to apply towards dividends.

The method of planing cylinders, illustrated in Fig. 1, is exceedingly slow and considerable money would be saved by the use of a sufficiently large planer, an open sided planer, or a peculiar type of planer used in ship yards, the name of which I do not know. This last machine is particularly well adapted to the planing of locomotive cylinders and would also be useful for other railroad shop work. It consists of a rigid, stationary bed to which the work is clamped and of a tool carriage which travels back and forth on ways alongside of and parallel to the bed. This machine is very powerful and would simply walk away with the cylinder work and what is even more important it would plane two or three cylinders at the same time. If a railroad shop cannot get an appropriation to buy such a machine, it can at least convert a planer into something like it and beat the methods in use at present. A rigid bed, bolted to a solid foundation alongside of the planer, and a tool holder carried by a suitable device mounted on the planer table would do the trick, and, when not in use, the supplementary bed could be moved out of the way by the crane.

Fig. 9 shows a method of "Threading Grease-Cup Plugs" and at once makes one wonder why anyone would make such a nice threading die and then hold it down with a U-clamp which is liable to slip at any moment. However, that is not the point, but why use such an expensive method? The automobile manufacturers make thousands of plugs like these, but they do not thread them one at a time in a drilling machine. Perhaps the *American Machinist* will publish for the benefit of the railroad shops, a description of the automobile shop method.

Even a small railroad uses an almost incredible number of grease-cup plugs every year because they are lost and seem to even get clear off the right of way. Most of this loss could be avoided, but that is another story. If the railroad shops must thread grease-cup plugs in a makeshift manner, they should at least use multiple spindle drilling machines or adapt a bolt threading machine to the work so that one man can thread three or four times as many cups per hour as by the one at a time method.

Celluloid Templets

BY ATOL MAKER

Certain types of templets are ordinarily made from thin sheet brass, aluminum or whatever other metal happens to be at hand. The lines are laid off upon the sheet metal and then filed to form.

If the required templets be not too large, they can be produced very rapidly from sheet celluloid. Old celluloid taken from automobile curtains when it begins to crack is the proper material. Exposure makes the celluloid brittle and it will break along the lines that have been laid off with scriber and dividers, thus eliminating the filing which would be required to make a metal templet.

An additional feature of celluloid as templet material lies in its transparency. The celluloid can be laid upon a drawing and the lines traced upon it or should it be essential, lines upon work can be seen through the templet.

I am indebted to a toolmaker named Howe for my knowledge of the use of celluloid as a templet material.

Burners for Thermit Preheaters

In conducting extensive experiments with different types of burners to be used in connection with its standard Thermit preheaters the Metal & Thermit Corp., New York, found that the best results were secured with a burner pipe $\frac{3}{8}$ in. in dia., swaged down at one end and then drilled with a $\frac{1}{16}$ in. hole. Such a burner pipe fully atomizes the fuel before it enters the mold and gives the best combustion. It was found that when larger burners were used, or when ends had not been swaged down, considerable air and fuel were wasted. The fuel does not become fully atomized, with the result that raw oil is carried into the mold or is wasted by dripping from the end of the pipe.

Conservation, the Keynote of German Motor Industries

By HENRY OBERMEYER and ARTHUR L. GREENE

German automobile plants left with large excess capacity—Changes in design of product to meet present needs—Utilization of scrap material

IT REQUIRES less than half an eye to see that the German automobile industry has suffered a severe blow by the peace, and the only wonder is that it has been able to survive at all. In both England and America the industry seems to be suffering from temporary depression as made evident by the fact that prices are being slashed right and left, and that high powered and high priced cars are apparently giving way before less costly and less pretentious models. Therefore German motor manufacturers cannot be leaning very heavily on their export trade.

To the casual observer the situation presents a paradox. There seems to have been little if any diminution of automobile showrooms in the principal cities of Germany, and at least two large companies, Adler and Benz, have apparently thought it worth while to distribute a chain of their own garages and service stations throughout the country. All of them seem to be doing business.

Motor Cars Scarce on Main Roads

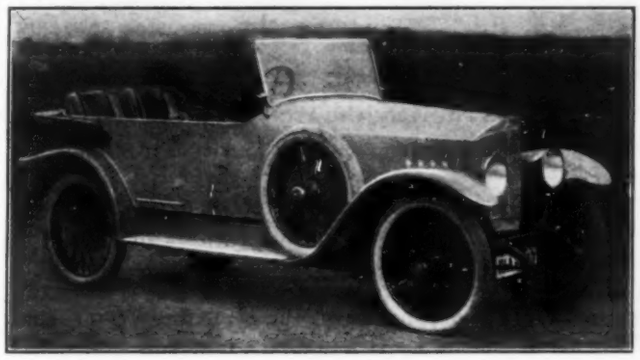
On the other hand—and here the picture is reflected truly—there are parts of Germany in which one can travel the main roads for an entire day without meeting a single touring car. Even in the larger cities, excepting Berlin, but including Hamburg, the decrease of motor traffic has led to pedestrians losing their habits of care while crossing the boulevards.

The actual fact, admitted by the managers of two of Germany's largest automobile factories, the Adlerwerke of Frankfurt-am-Main, and the Daimler-Motoren-Gesellschaft of Stuttgart, the latter makers of the Mercedes and Mercedes-Knight cars, is that the demand for the big machines, which have been the special, world-famous products of these two companies up to the present, has been reduced almost to the vanishing point.

The steps taken by both of these companies to counteract the effect of this condition so far as they are concerned are full of valuable hints and suggestions for the industry at large. They have gone about the matter from both ends, from that of production and from that of demand.

In connection with the first of these propositions German automobile manufacturers have for the past four years, some of them longer, concentrated much of their attention and energy on better and more efficient methods of factory administration, especially on the conservation of fuel and raw materials. The necessity for this step has been due not so much to the circumstances of the automobile market as to the scarcity of coal and iron in Germany today and the prohibitive prices of such material on the world market owing to the depreciation of the mark. It is this fact which makes Central Europe, industrially, one of the most interesting sections of the world at present. The tendency toward conservation was well begun during the war when Germany was so effectually cut off from foreign trade by the embargo of the British fleet. Since that time, under the pressure of a virtual money embargo, it has been brought to the dignity of a science.

The second proposition, respecting demand, is being



THE POST-WAR AUTOMOBILE OF GERMANY

met by degrees. The German people have not money enough to pay for limousines and heavy touring cars. Even if they had it would cost too much to run them. In Germany today upkeep plays a much larger rôle in affecting automobile sales than the original cost. For this reason German motor companies are seeking the solution of the problem by abandoning large scale production of heavy cars and concentrating on the output of lighter models.

Herr Dr. Seckler, manager of the Daimler Company, recently stated the problem in a graphic manner.

"First and foremost the German automobile industry is faced with the inescapable fact that the cost of running a first-class touring car or limousine on a pre-war scale costs the owner not a pfennig less than 10,000,000 marks a year," he said. "Only for running expenses, remember. This is estimated on the basis of a 15,000-kilometre run (9,375 miles). Itemized at the present cost of the various factors involved, this means an average of 2,500,000 marks for tires and inner tubes, 2,000,000 marks for benzine (gasoline), and the remainder

for taxes, repairs, garage expenses, oil, lights and the wages of a chauffeur. Automobile taxes in Germany are levied on the horsepower. Therefore, with these other factors in addition, you can see for yourself what the automobile industry is facing. To save ourselves it has become imperative for us to create a demand—or rather, to supply a new demand already vocal—for a machine which can at least be run at a reasonable cost."

Price of Fuel Exorbitant

The single item of motor fuel, as a matter of fact, has been sufficient to drive many cars off the road. Early in October, for example, the writers were paying 250 marks per liter (slightly less than a fifth of a gallon) for gasoline. Two months later they were paying a thousand marks, something over sixty cents a gallon at the prevailing rate of exchange.

In working on plans for a lighter car, the Daimler and Adler companies have naturally sought to retain most of the qualities of endurance and general appearance of their larger models. For 1923 Daimler presents two models, the 6/25-horsepower and the 10/40-horsepower.

Adler has been working until recently on a 6/18 and a 6/22 model, but lately abandoned the first in favor of the latter. This company, which also manufactures bicycles and typewriters on a large scale, is not, of course, so much dependent on the temporary condition of the motor industry. It is notable, however, that both this and the Daimler company refuse to have the obvious recourse to the manufacture of motorcycles, the sales of which throughout Germany seem to be substantially increasing as the sales of automobiles decline. Adler especially is in a favorable position for such an attempt. It was the first concern in Germany to manufacture bicycles, and actually did make motorcycles for a time, although it had abandoned this line several years before the war. It is not unlikely, therefore, that time may see this company re-entering the motorcycle field, especially if conditions grow much worse.

As before noted, conservation has received the special attention of German engineers ever since the war, when it became not merely a policy but a necessity. The difficulty of obtaining raw materials has led in many quarters to the fear that automobile and other machine manufacturers of Germany would not be able to maintain the prewar standard of their product.

It is declared that this fear has not been realized as yet, but the possibility is fully recognized. Since Germany does not supply enough coal or iron for its own industries and since the difficulty of obtaining them elsewhere is certainly growing no less, the country as a whole has been compelled not merely to save what it has, but to invent new ways of saving it.

Probably no other factory has taken more care than has the Daimler plant in collecting every particle of scrap and shavings that accumulate in the course of manufacture and in restoring it to use. The length of a city block in the heart of the factory grounds is built up solidly with storage sheds used for no other purpose than salvage. Everything of possible use is separated, and each shed—there are twenty of them—is confined to its own classification, one for copper, one for iron, one for steel, one for returned and defective parts, one for carbon, and so on down the line. Such an extensive system of salvage has been of only recent inception there.

By a strict policy of conservation on the one hand and by a reasonable attempt to adapt the old automobile models to a modified demand, both the Adler and Daimler companies believe they will have escaped many difficulties which the present long continued situation would have forced upon them otherwise. Of the remaining problems, the normal after war readjustment, from which all machine industries of the warring nations suffered in varying proportions, has been satisfactorily accomplished. The labor question, though always full of dynamite, is not causing any great concern at the moment of writing except in so far as demands for increased wages continue to pile up.

THE DAIMLER FACTORY DURING THE WAR (AT LEFT) AND NOW. NOTE WASTE SPACE IN LATER PHOTOGRAPH

The Daimler plant, like so many factories which engaged in making war materials during the conflict, found itself not only distended beyond its requirements when the fighting ceased, but also found itself working on lines quite other than those for which it was originally built and which it intended to resume with the coming of peace.

Motor Factories Hard Hit

One can be assured, at least, that the Daimler company had nothing to do with the bringing of war. It came at the very time when the reputation of the Mercedes was at its height as the result of the Grand Prix races of 1914 in which Daimler cars won the first three places. War was declared two months later, and shortly afterward the Daimler factory was requisitioned by the Government for the making of airplane motors. During this time the plant increased sixfold, and it was as such that the company faced the problems of peace and the resumption of normal production.

Obtaining raw materials, power, coal and efficient labor was difficult enough, but not more difficult than transforming the factory from an aero-motor plant to an automobile plant once more. It was more than a

year after the revolution before the first completed car was ready for the market. During that time more than 10,000 men, as compared with a total force of 3,600 before the war, were engaged merely on the preliminaries of production. Since 1919 more than 6,000 of them have been discharged.

It was hoped that the post-war demand for automobiles would be strong enough to keep not only the entire personnel, but also the new shops and other newly constructed additions to the plant engaged. As it has happened, however, there are again less than 4,000 men at work, and although the new shops are being used as a matter of convenience, none of them is working at capacity. It is worth mentioning in passing that the new machines purchased since the readjustment are nearly all of German manufacture, whereas before the war America was the preferred source of automatic process machinery. In the estimation of the Daimler company and other German manufacturers, such native concerns as the Alfred Schütte Company of Cologne have succeeded in equaling if not surpassing the American product.

So far as labor is concerned, the German workmen seem to have taken matters pretty much into their own hands. Their councils compel a reconsideration of wage schedules every month, sometimes every two weeks. By the establishment of canteens, selling depots and co-operative buying agencies they have insured themselves at least a ten per cent reduction on the necessities of life. On weekdays overtime is generally paid for at twenty-five per cent, and on Sundays, when repairs, etc., are made, overtime is as high as fifty per cent. Nevertheless it is still claimed for the German workman that his standard of living is only a fourth to a sixth of what it was before the war.

Ordinary hand labor is easy enough to obtain. Skilled workmen, however, are a different problem, and the Daimler Company, at least, has found it advisable to extend its school of apprentices, who now number 300. It was formerly the custom for apprentices to pay for their training, but Daimler has abandoned this method in favor of paying a nominal wage.

All these are problems of the day. As a matter of fact, the greatest problem of all, which is common to all German industries, has not been touched on in these observations at all, chiefly because it is without any apparent solution except that of time—namely, the variable future, which, from day to day, becomes the unsettled present. Anything may happen, and, in the course of a year, it usually does at least once.

Belt Drives in the Machine Shop

By F. P. Terry
Belfast, Ireland

One of the troubles of the machine shop foreman is the difficulty of getting rid of stoppages caused by belt failures. Many of these are attributable to the fact that there are still in use many machine tools that were never designed to use high-speed steel and until these are worn out or replaced, there can be little hope to avoid excessive wearing out and breaking of driving belts.

Apart from cases of this sort, one may be excused for asking the question, Does the machine tool manufacturer do all he can to help the machine shop foreman in this respect? Personally I am convinced that few of them do, and some of them seem to have adopted the policy of using pulleys as narrow as possible, so that the belts are fully loaded at all times and, should anything occur, the belts give out, saving the machine and the manufacturer's reputation. Very often the belting manufacturer is blamed unjustly for supplying bad belting.

Some years ago I read an advertisement offering £1,000 reward for a substitute for leather belting, the only conditions being that it must have the same frictional grip on the pulleys, stand the slam banging of belt forks, and after years of service be available for cutting up into smaller belts and other things common to leather. Since that time I have had a good deal of respect for leather belts, but very often they are called upon to do the impossible.

Wide Belt Cheaper in Long Run

Over a dozen years ago, we purchased a 15-in. American engine lathe and also one of the same size of British manufacture. The American lathe was fitted with an 8-in. single leather belt on a single pulley drive, while the British lathe required only a 4-in. belt for the cone pulley. During that time the British lathe has worn out four belts, two of them double, while the 8-in. belt on the American lathe is still working away and looks as if it might be good for some years yet. All the belting has been of the same make, and practically no better service was obtained from the double belting than the single; due, I think, to a good deal of its work being on the smallest cone of the countershaft. The British lathe is sturdily built and is satisfactory, but when it comes to heavy duty it is always the belt that fails, and I am firmly convinced that a 6-in. belt would increase its value considerably.

Some six months ago we received a machine tool, the countershaft of which carried a pair of 4 in. wide fast and loose pulleys for the main shaft drive, the loose pulley being about 1 in. smaller in diameter than the fast pulley. Partly because I do not like this arrangement and partly because the countershaft was very close to the main shaft, giving a very short drive, I replaced these pulleys with two 6 in. ones of equal diameters. When the operator arrived to start up the machine he was most indignant at my improvement and was in doubt whether to touch the machine or not and told me as plainly as possible without actually saying so, that nobody but a fool would do what I had done.

To my question, "Why is the loose pulley smaller than the fast one?" he replied, "To save the belt."

"But," I said, "A belt working under proper conditions doesn't need saving."

"Well," he said, "It saves the countershaft journals anyway."

"No it doesn't," I replied. "The journals only get the load when the belt is on the fast pulley, and your beautiful design is the best thing I know for ruining belts and journals. My 6-in. belt will work with very little more tension on the shaft than would be caused by your 4-in. belt when on the loose pulley, certainly much less than when it is on the driving pulley, consequently I avoid squealing belts and hot journals."

We reverted to the subject several times before he left me, and, as he never had the slightest complaint that my belt prevented him from getting maximum output, I am sure he was convinced. I wouldn't be surprised to find a pair of 6 in. wide pulleys on the next machine of that kind we buy.

Manufacture of Machinery During 1921

THE Department of Commerce announces that reports made to the Bureau of the Census show considerable decreases in the value of various kinds of machinery manufactured during 1921 as compared with 1919, although in a few cases there are slight increases.

Comparative data concerning the output of some of the principal classes of machinery in 1921, 1919 and 1914 are given in the statement below. It is not to be assumed that the amounts reported cover in all cases the entire production—it is possible that in some instances machinery specifically called for was not reported separately. Some machinery is capable of use in a number of different industries, and the manufacturers were not always able to designate the industry using it. Agricultural implements, tractors and engines, and electrical apparatus are not included in this report.

The figures for 1921 are preliminary and subject to such change and correction as may be found necessary from a further examination of the original reports.

SUMMARY OF STATISTICS FOR THE MANUFACTURE OF MACHINERY—1921, 1919, 1914

Class	1921 Number of Establishments	1921 Value of Products	1919 Number of Establishments	1919 Value of Products	1914 Number of Establishments	1914 Value of Products
Total	...	$1,225,059,000	...	$1,590,234,000	...	$380,596,000
Adding and calculating machines	58	30,016,000	58	53,993,000	44	14,734,000
Air compressors	71	15,729,000	44	18,650,000	84	5,158,000
Bakers' machinery	60	10,560,000	68	9,359,000	32	2,555,000
Blowers and fans	74	12,518,000	69	12,141,000	...	*
Bottling machinery	47	6,642,000	46	10,468,000	29	1,359,000
Brick, pottery, and other clay working machinery	75	3,772,000	49	3,187,000	89	2,439,000
Canning machinery	74	5,139,000	...	*	...	*
Cash registers and parts	16	23,944,000	21	31,574,000	19	15,935,000
Concrete mixers	67	8,666,000	62	10,450,000	44	2,956,000
Condensers	22	8,065,000	19	24,216,000	...	*
Cotton gins	18	2,721,000	25	10,176,000	25	4,902,000
Confectioners' machinery	39	5,157,000	53	9,341,000	...	*
Cranes:						
Electric	41	12,037,000	36	27,325,000	...	*
Other	58	8,408,000	75	25,209,000	26	4,194,000
Dairy machinery	71	17,759,000	140	34,279,000	78	12,998,000
Dredging and excavating machinery	50	4,991,000	47	9,108,000	21	2,969,000
Elevators and elevator machinery:						
Electric	117	29,414,000	94	29,607,000	...	*
Other	121	11,518,000	157	40,580,000	213	17,228,000
Firearms, ordnance, and ammunition machinery	5	132,000	15	2,854,000	...	*
Flour-mill and gristmill machinery	90	8,663,000	106	19,981,000	101	5,018,000
Gas machines and apparatus	34	4,554,000	70	7,898,000	90	4,426,000
Glass-making machinery	34	4,088,000	24	3,316,000	30	1,091,000
Hydraulic rams	15	1,122,000	10	3,597,000	...	*
Laundry machinery:						
Power machines	44	8,585,000	32	10,801,000	73	6,135,000
Other	23	4,398,000	27	3,090,000	35	1,430,000
Lawn mowers	22	6,401,000	19	3,777,000	22	2,848,000
Leather-working machinery, other than shoe	42	2,526,000	51	4,691,000	27	1,067,000
Machine tools	383	69,254,000	403	212,400,000	...	*
Metal-working machinery, other than machine tools	141	19,288,000	211	57,541,000	277	17,420,000
Meters, gas and water	45	18,181,000	111	27,765,000	40	11,638,000
Mining machinery, exclusive of oil-well machinery	164	30,290,000	133	51,243,000	153	13,254,000
Motion-picture machinery	16	2,869,000	23	3,606,000	...	*
Oil-well machinery	145	27,415,000	89	28,351,000	127	10,569,000
Oil-mill machinery, cottonseed and other	19	1,472,000	26	11,306,000	20	1,878,000
Ore crushers	26	3,322,000	22	2,367,000	...	*
Packing-house machinery	40	4,133,000	...	*	...	*
Paper and pulp mill machinery:						
Paper mill	73	17,388,000	53	11,295,000	...	*
Pulp mill	32	5,155,000	16	1,385,000	...	*
Other machinery used in the paper industry	81	9,038,000	109	14,741,000	139	8,588,000
Photo-engraving machinery	11	830,000	6	733,000	...	*
Printing machinery:						
Presses	77	22,368,000	58	18,434,000	88	8,397,000
Typesetting machines	12	19,650,000	9	14,878,000	10	7,635,000
Other	83	12,852,000	102	20,013,000	56	3,197,000
Pumps and pumping machinery	334	69,891,000	222	66,456,000	298	27,457,000
Refrigerating machinery:						
Ice making	74	14,806,000	48	15,665,000	...	*
Other refrigerating	67	18,368,000	46	15,002,000	73	10,522,000
Road-making machines	93	17,858,000	58	15,778,000	31	3,545,000
Rubber- working machinery	64	8,005,000	71	17,002,000	14	2,726,000
Sand-blast machines	13	622,000	15	1,320,000	...	*
Sewing-machines, cases, and attachments	36	35,608,000	45	57,938,000	50	27,238,000
Shoe machinery	60	9,482,000	61	16,261,000	72	5,949,000
Slot-vending machines	25	2,466,000	26	1,646,000	...	*
Steam shovels	20	12,858,000	8	12,454,000	...	*
Stokers, mechanical	29	7,161,000	13	4,280,000	...	*
Sugar-mill machinery	54	12,075,000	56	14,847,000	42	1,972,000
Textile machinery and parts	445	129,948,000	432	122,089,000	...	*
Typewriters and parts	30	33,361,000	39	43,313,000	53	20,517,000
Vacuum cleaners:						
Electric	34	20,356,000	25	19,521,000	...	*
Other	17	1,370,000	10	1,941,000	39	2,059,000
Washing machines	138	32,444,000	115	42,896,000	...	*
Well-drilling machinery, other than oil wells	32	1,353,000	30	2,567,000	...	*
Windmills	33	6,997,000	32	9,933,000	50	5,843,000
Wire-drawing machinery	14	367,000	20	1,402,000	...	*
Woodworking machinery:						
Sawmill	115	7,901,000	89	15,039,000	182	6,304,000
Planing-mill	68	10,177,000	34	6,732,000	...	*
Other	138	7,568,000	146	14,992,000	196	7,089,000
Other machinery	...	117,628,000	...	121,930,000		67,357,000
Machine parts and castings	...	125,361,000	...	53,504,000		

* Not reported separately.

Manufacture of Cutlery and Edge Tools, 1921

The Department of Commerce announces that according to reports made to the Bureau of the Census the value of products of establishments engaged primarily in the manufacture of cutlery and edge tools amounted to $49,341,000 in 1921 as compared with $66,630,000 in 1919, and $25,541,000 in 1914, a decrease of 26 per cent from 1919 to 1921, but an increase of 93 per cent for the seven-year period, 1914 to 1921.

This industry includes the manufacture of table cutlery, pocket knives, razors, scissors, shears, augers, gimlets, chisels, planes, meat choppers, axes, hatchets, and implements of a similar character.

Seeing Ourselves Through the Census

A Story in Charts and Figures

Analytical data on machine shops and foundries—Some figures on steam railroad repair shops—Graphical work of the National Industrial Conference Board

SUBMERGED in the statistics of the various censuses of manufactures are available business stories without end. Like almost all things really good, they are hard to get at. If the world possessed a census of manufactures (or wealth produced) by five year periods since the beginning of time, there could be read from it the stories of the rise and fall of individual industries that were born of necessity, grew, declined and finally outlived their usefulness as other industries took their places in the development of modernization.

No such world statistics exist nor are there statistics for the entire life of the United States. But the story of the industrial life of this country from 1849 to date is fairly complete as told in the government census figures obtained in 1850 and at intervals thereafter.

Census figures are not revealing of themselves; they have to be studied, analyzed, interpreted. One census should be compared with others. The figures should at times be juggled around to bring them into better perspective.

An excellent work of this kind has been done by the National Industrial Conference Board, New York City and published in book form under the title "A Graphic Analysis of the Census of Manufactures of the United States, 1849-1919." A part of the summary figures and five of the charts are reproduced to show certain facts about the industries which have been classed under the heading, "Foundries and Machine Shops." A few figures on "Steam Railroad Repair Shops" have been included because of the size and importance of the group in absorbing the products of foundries and machine shops. Before reading them an acquaintance with some of the premises upon which the census were made is advisable.

The first census of manufactures was taken in 1850 for the year 1849. Similar statistics were taken every decade up to 1900 and since 1900 censuses have been taken at intervals of 5 years. Plants idle during the entire year of a census were not included and in all cases $500 was the low limit of the value of the products manufactured during the year. Production below that amount was not included.

In referring to the value of products manufactured, the term *manufactured* is not to be confused with the value of the product *sold*, although the value of the products manufactured was based on selling price. The value added to materials by manufacture is substantially the difference between the cost of the materials and the value of the products.

The size of the industries included under "Foundries and Machine Shops" may be appreciated by comparing the figures in the accompanying table with the following figures on the total number of persons engaged in the manufacturing and mechanical industries in 1919:

Total population of the United States	105,710,620
Engaged in manufacturing and mechanical industries	12,818,524
Expressed in percentage of total population	12.1

The proportion of persons employed in manufacturing and mechanical industries to total population in 1870 was 20.1 per cent. The number of persons so engaged was 2,512,000.

There are several facts about foundries and machine shops as they were in 1919 that need to be emphasized, of especial importance the five that follow:

The percentage distribution of personnel by occupational groups
Sizes of establishments
Character of ownership
Percentage of total wage earners employed in establishments operating for specified work periods.

Expressed in percentage the figures on personnel are as follows:

Proprietors and firm members	1
Salaried officers of corporations	4.5
Subordinate salaried employees	10.6
Percentage of total persons employed	16.1

This figure of 16.1 per cent is comparable to the figure 15.9 per cent for all industries of the United States and indicates that the foundry and machine shop industry is very close to the average.

In regard to sizes of establishments, the figures show that

16 per cent employ from 0 to 50 persons
32 per cent employ from 51 to 250 persons
32 per cent employ from 251 to 1000 persons
20 per cent employ over 1000 persons

Figures for steam railroad shops have been included in the next two sets of figures, which point out character of ownership and percentage of total wage earners.

The 14th Census Act provides that for the years 1921, 1923, 1925 and 1927 and every tenth year after each of those years, statistics of the products on manufacture in industries shall be collected and published. Prior to the passage of this act, the census of manufactures was on a five-year basis, covering operations for the years 1919, 1914, 1909, etc. The biennial census is therefore substituted for the quinquennial census. On account of the limitation on appropriations and time, the schedule was abridged in some respects, the 1921 schedule omitting the inquiries for capital invested, wage earners by sex, rents and taxes, power employed in manufacture and fuel used. As the situation now stands, there will be taken in a decade four biennial censuses, following the method of the 1921 census with a full census of manufactures every tenth year. The 1921 census is much more full and complete than was contemplated originally, in carrying out the provisions of the act which require a census of the products of manufacturing industries, and it represents substantially about three-fourths of the work involved in the regular quinquennial census.

The charts used in this article are copyrighted by the National Industrial Conference Board.

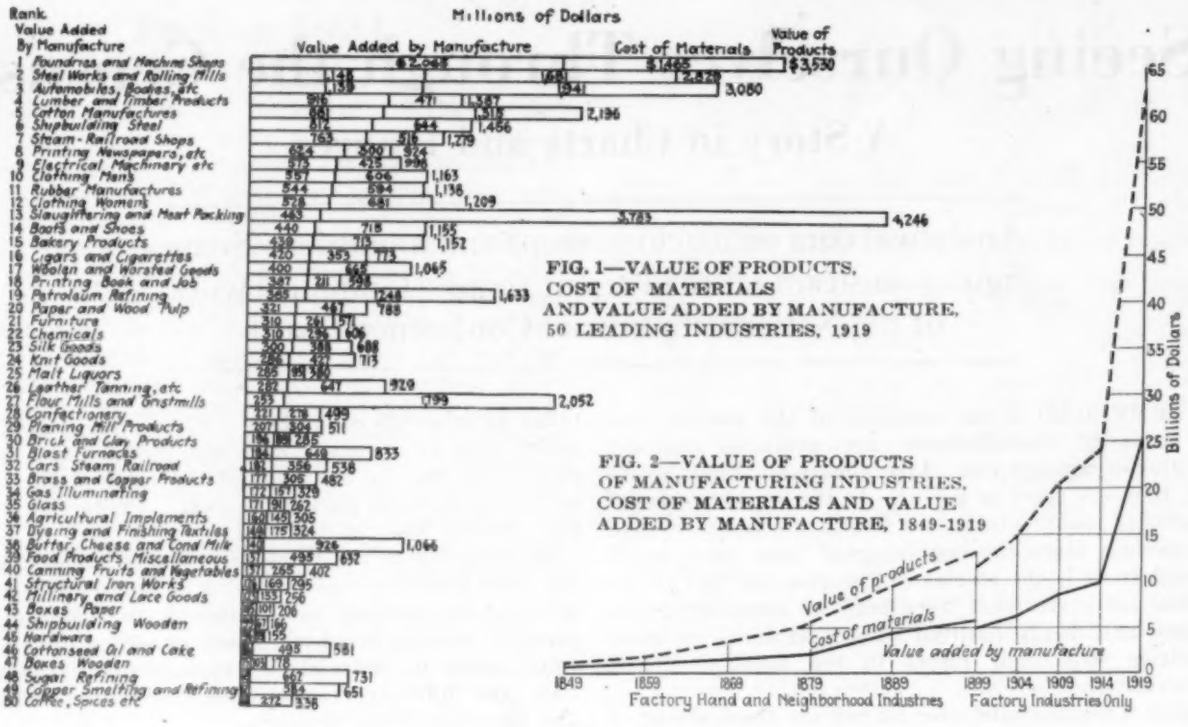

Millions of Dollars
Rank. Value Added By Manufacture
Value Added by Manufacture
Cost of Materials
Value of Products
1 Foundries and Machine Shops $2,068 $1,465 $3,530
2 Steel Works and Rolling Mills 1,148 1,681 2,829
3 Automobiles, Bodies, etc 1,139 1,941 3,080
4 Lumber and Timber Products 916 471 1,387
5 Cotton Manufactures 681 1,515 2,196
6 Shipbuilding Steel 812 644 1,456
7 Steam-Railroad Shops 763 516 1,279
8 Printing Newspapers, etc 624 300 924
9 Electrical Machinery etc 315 421 736
10 Clothing Men's 557 606 1,163
11 Rubber Manufactures 544 594 1,138
12 Clothing Women's 728 481 1,209
13 Slaughtering and Meat Packing 461 3,785 4,246
14 Boots and Shoes 440 715 1,155
15 Bakery Products 439 713 1,152
16 Cigars and Cigarettes 420 353 773
17 Woolen and Worsted Goods 400 665 1,065
18 Printing Book and Job 387 211 598
19 Petroleum Refining 385 1248 1,633
20 Paper and Wood Pulp 321 467 788
21 Furniture 310 261 571
22 Chemicals 310 296 606
23 Silk Goods 300 388 688
24 Knit Goods 286 429 715
25 Malt Liquors 285 95 380
26 Leather Tanning, etc 282 647 929
27 Flour Mills and Gristmills 253 1799 2,052
28 Confectionery 211 278 489
29 Planing Mill Products 207 304 511
30 Brick and Clay Products 194 138 285
31 Blast Furnaces 184 649 833
32 Cars Steam Railroad 182 356 538
33 Brass and Copper Products 177 305 482
34 Gas Illuminating 172 157 328
35 Glass 171 191 262
36 Agricultural Implements 160 145 305
37 Dyeing and Finishing Textiles 149 175 324
38 Butter, Cheese and Cond Milk 140 926 1,066
39 Food Products, Miscellaneous 137 495 632
40 Canning Fruits and Vegetables 137 265 402
41 Structural Iron Works 126 169 295
42 Millinery and Lace Goods 123 133 256
43 Boxes Paper 101 105 206
44 Shipbuilding Wooden 100 31 131
45 Hardware 97 155 252
46 Cottonseed Oil and Cake 88 493 581
47 Boxes Wooden 87 118 205
48 Sugar Refining 64 667 731
49 Copper Smelting and Refining 57 594 651
50 Coffee, Spices etc 62 272 336

FIG. 1—VALUE OF PRODUCTS, COST OF MATERIALS AND VALUE ADDED BY MANUFACTURE, 50 LEADING INDUSTRIES, 1919

FIG. 2—VALUE OF PRODUCTS OF MANUFACTURING INDUSTRIES, COST OF MATERIALS AND VALUE ADDED BY MANUFACTURE, 1849-1919

WAGE EARNERS
RANK 1919
THOUSANDS OF WAGE EARNERS
1899
1919
400,000 and over
1 Foundries and machine shops 353 733
2 Steam railroad shops 174 484
3 Lumber and timber products 413 481
4 Cotton manufactures 363 447
200,000 to 400,000
5 Steel works and rolling mills 183 375
6 Shipbuilding-steel 31 344
7 Automobiles, bodies, etc 2 343
8 Electrical machinery etc 42 212
9 Boots and shoes 142 211
100,000 to 200,000
10 Clothing-men's 121 175
11 Knit goods 84 173
12 Woolen and worsted goods 126 167
13 Clothing-women's 84 166
14 Slaughtering and meat packing 68 161
15 Rubber manufactures 32 159
16 Bakery products 60 142
17 Cigars and cigarettes 103 139
18 Furniture 87 138
19 Silk goods 65 127
20 Printing-Book and job 68 123
21 Printing-news,papers,etc 95 120
22 Paper and wood pulp 50 114
23 Brick and clay products 105 106
50,000 to 100,000
24 Planing mill products 74 89
25 Confectionery 27 80
26 Glass 53 78
27 Chemicals 18 76
28 Brass and copper products 27 75
29 Leather-tanning, etc 52 72
30 Canning-fruits and vegetables 37 61
31 Petroleum refining 12 59
32 Dyeing and finishing textiles 30 56
33 Boxes-paper 26 56
34 Agricultural implements 47 54
35 Cars-steam railroads 33 52
36 Millinery and lace goods 17 51
25,000 to 50,000
37 Flour mills and gristmills 32 45
38 Blast furnaces 39 44
39 Structural iron work 25 44
40 Shipbuilding-wooden 16 43
41 Gas-illuminating 22 43
42 Hardware 26 43
43 Boxes-wooden 22 42
44 Butter, cheese and cond. milk 6 35
45 Malt liquors 34 39
46 Food products-miscellaneous 8 30
47 Cottonseed oil and cake 11 27
Under 25,000
48 Sugar refining 18
49 Copper smelting and refining 10 17
50 Coffee, spices, etc 6 13

FIG. 4—WAGE EARNERS EMPLOYED IN 50 LEADING INDUSTRIES, 1899-1919

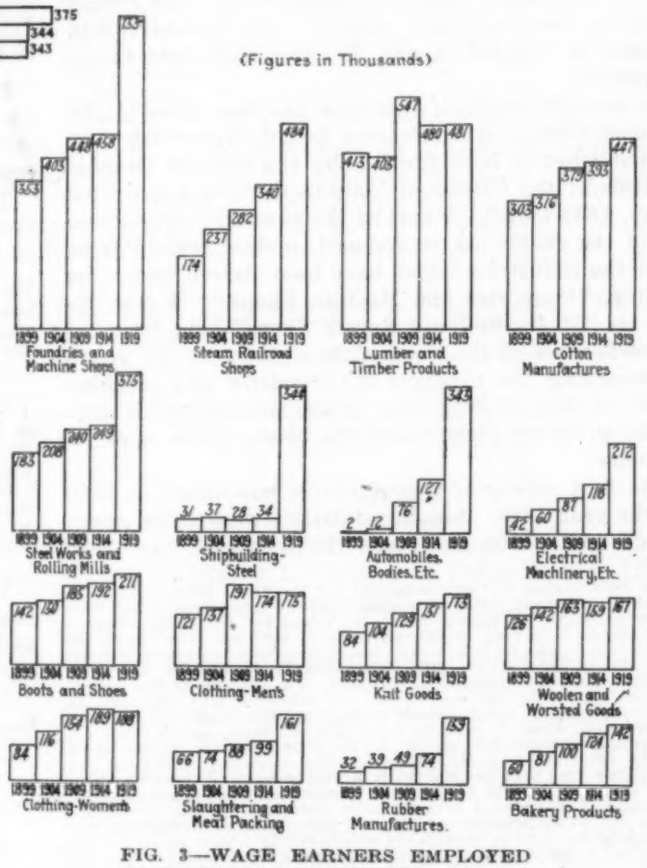


FIG. 3—WAGE EARNERS EMPLOYED IN 16 LEADING INDUSTRIES, 1899-1919

PERCENTAGE OF WAGE EARNERS EMPLOYED IN ESTABLISHMENTS OWNED BY

	Foundries and Machine Shops	Steam Railroad Shops
Corporations	92.4	100
Individuals	4.1	...
Others	3.5	...

(Figures refer to 1919 census)

PERCENTAGE OF WAGE EARNERS EMPLOYED IN ESTABLISHMENTS OPERATING

	Foundries and Machine Shops	Steam Railroad Shops
60 hours or over	4.6	0.7
Between 54 and 60 hours	20.2	22.4
48 to 54 hours (including 54)	39.1	3.7
48 hours and under	36.1	73.2

(Figures refer to 1919 census)

The five charts are given primarily to show the industrial positions occupied by the foundries and machine shops and steam railroad shops, and secondarily to give examples of the form of interpretation by the National Industrial Conference Board in its book.

Foundries and machine shops, as shown in Fig. 1, are the first of the fifty leading industries in value added by manufacture and value of products; they are fifth in cost of materials. Steam railroad shops are seventh in value added by manufactures, tenth in value of products and twentieth in the cost of materials. The values are those of 1919.

Additional value due to manufacture is shown in Fig. 2, which shows also the cost of materials and the value of products. The chart covers the period from 1849 to 1919 and is for all manufacturing industries, divided into the classifications "factory, hand and neighborhood industries" for the period 1849 - 1899 and "factory industries only" for the period 1899-1919, in order to conform to the censuses as taken.

Foundries and machine shops and steam railroad shops rank respectively first and second in number of wage earners employed, Fig. 3. The chart is arranged for comparison of the 16 leading industries for the period from 1899 to 1919.

The next chart, Fig. 4, is similar to that of Fig. 3, in that it deals with persons engaged in manufacturing. It indicates the number of wage earners employed in 50 leading industries, for the year 1899 and for the year 1919.

Perhaps the most valuable of the charts is the one shown in Fig. 5, enumerating the major items of expenditure given in percentages of the total value added by manufacture. The industries are ranked according to proportion of wages to value added by manufacture, and as would be expected, steam railroad shops are first with a percentage of 90. The other percentages are: Salaries 8.8; taxes 0.4; and miscellaneous expenses and profits 0.8. For foundries and machine shops, which rank thirteenth in proportion of wages paid to total value added by manufacture, the figures are: Wages 45.9; salaries 12.9; taxes 7.5; and miscellaneous expenses and profits, 33.7.

We know that the machinery industries are big; but just how big we fail to realize until we have before us concise statements, or better still graphs, drawn from reliable data. We need also similar information about other industries, to complete the picture. To understand "trend," we need more still—the same information about the same industries at other periods. The few statistics and charts given here concern only what we may call the machinery industries and as such are valuable, but they are by no means all of the census.

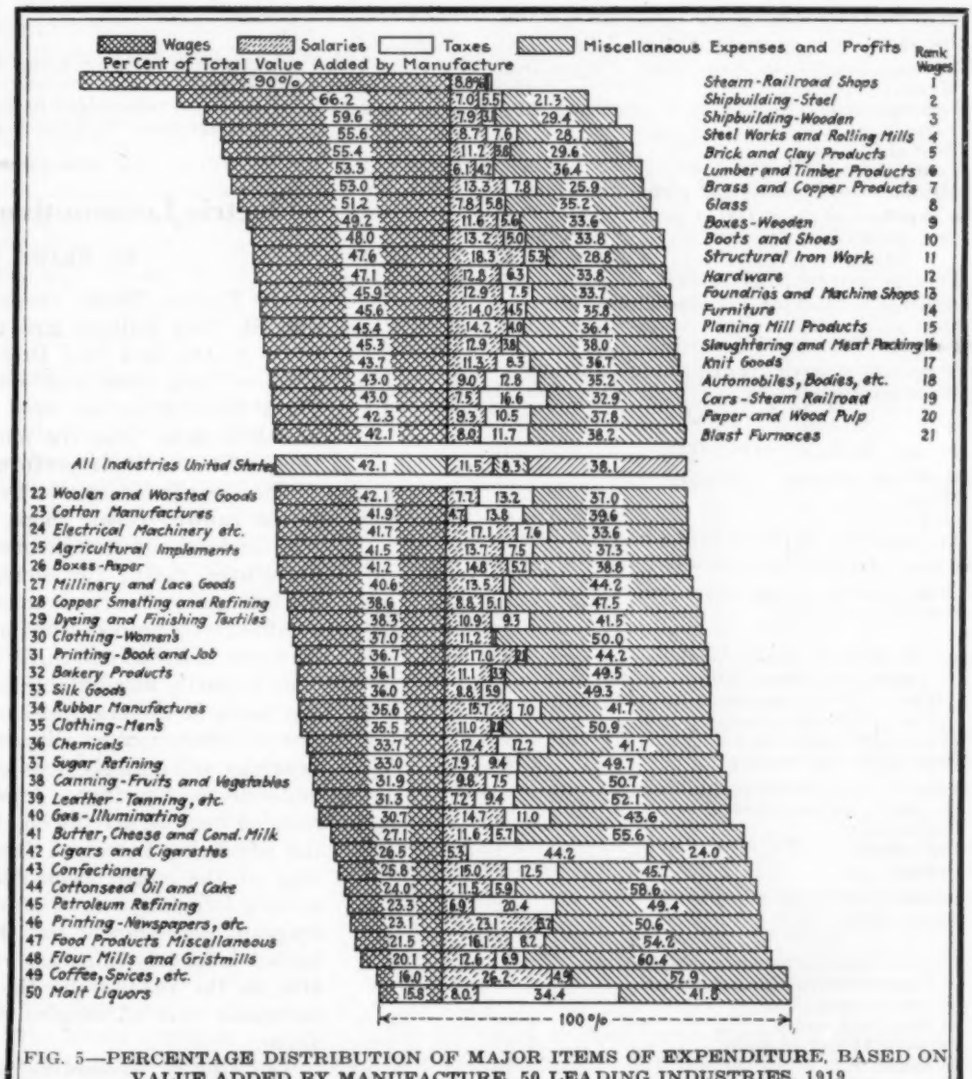


FIG. 5—PERCENTAGE DISTRIBUTION OF MAJOR ITEMS OF EXPENDITURE, BASED ON VALUE ADDED BY MANUFACTURE, 50 LEADING INDUSTRIES, 1919

SUMMARY TABLE, FOUNDRIES AND MACHINE SHOPS AND STEAM RAILROAD SHOPS

	Foundries and Machine Shops	Steam Railroad Shops
Total number of persons in industry (1919)	873,274	516,279
Percentage distribution by occupational groups (1919):		
Overhead personnel:		
Proprietors and firm members	1.0	(a)
Salaried officers of corporations	1.5	(a)
Superintendents and managers	3.0	3.0
Subordinate salaried employees	10.6	3.2
Total overhead personnel	16.1	6.2
Wage earners	86.8	93.8
Number of wage earners employed		
(1899)	352,574	173,595
(1914)	457,799	339,518
(1919)	733,371	484,437
Wage earners, per cent increase, 1899 to 1914	29.8	95.6
Wage earners, per cent increase, 1899 to 1914	108.0	179.1
Wage earners per unit of management (1914)	16	50
(1919)	15	31
Female wage earners—per cent of total wage earners (1914)	1.2	0.1
(1919)	3.2	0.9
Wage earners under 16—per cent of total wage earners (1919)	0.42	0.01
Value of products (1919)	$3,530,422,000	$1,279,235,000
Cost of materials (1919)	1,465,492,000	515,803,000
Value added by manufacture (1919)	2,064,930,000	763,432,000
Percentage distribution, major items of expenditure (d)		
Wages	45.9	90.0
Salaries	12.9	8.8
Taxes	7.5	0.4
Rent of factory	0.4	(a)
Contract work	0.5	0.2
Miscellaneous expenses and profits	32.8	0.6
Tax expenditure per $1,000 of products (1914)	$8.63	$3.32
(1919)	$43.87	$2.27
Per cent increase, 1914 to 1919	408	—32 (b)
Percentage distribution, tax expenditure (1919)		
State	14.7	99.3
Federal	85.3	0.7
Average cost of service per employee—month		
Wage earners (1899)	$43.31	$46.09
(1914)	56.18	57.55
(1919)	107.54	118.27
Per cent increase, 1914 to 1919	91	106
Subordinate salaried employees		
(1914)	$85.77	$74.70
(1919)	110.64	130.97
Per cent increase, 1914 to 1919	29	75
Per cent salaries (e) exceeded wages	3	11
Average number of wage earners per establishment (1899)	38	134
(1919)	55	278
Per cent of wage earners in establishments employing (1919)		
0 to 50 wage earners	16	3
51 to 250 wage earners	32	17
251 to 1,000 wage earners	32	42
Over 1,000 wage earners	20	38
Per cent of wage earners in establishments owned by (1919)		
Corporations	92.4	100.0
Individuals	4.1	.....
Others	3.5	(a)
Per cent of average fluctuation in employment (1914)	5.1	1.5
(1919)	3.7	2.7
Per cent of wage earners in establishments where prevailing workweek was:		
44 hours and under	7.65	0.60
Between 44 and 48 hours	2.35	9.39
48 hours	26.09	63.29
Between 48 and 54 hours	25.33	2.20
54 hours	13.77	1.46
Between 54 and 60 hours	20.17	22.38
60 hours	4.39	0.41
Over 60 hours	0.25	0.27
Per cent of wage earners in establishments where prevailing workweek was		
48 hours and under (1914)	6.8	21.9
(1919)	36.1	73.3
Installed primary power		
Horsepower (1899)	381,623	95,087
(1914)	964,657	433,994
(1919)	1,604,211	594,515
Per cent increase, 1914 to 1919	66.2	36.9
Horsepower per wage earner (1899)	1.1	0.6
(1914)	2.1	1.3
(1919)	2.2	1.2
Percentage distribution, installed primary power, by types of power (1919)		
Steam engines and turbines	31.76	63.18
Water-wheels and motors	1.11	0.14
Internal combustion engines	4.96	1.18
Electric motors—purchased current	61.18	34.92
Other purchased power	0.99	0.58
Horsepower of electric motors—per cent of primary power (1919)		
Run by purchased current	61.2	34.9
Run by current generated in establishments	33.3	49.2
Total	94.5	84.1
Percentage distribution of fuels, based on heating values (1919)		
Bituminous coal	58.9	81.0
Anthracite	4.6	6.7
Coke	19.9	2.8
Gas	9.2	1.1
Oil	7.4	8.4

(a) Less than one-tenth of one per cent
(b) Decrease
(d) Based on value added by manufacture
(e) Average cost of service subordinate salaried employees

Electric Locomotive Repairs at Tacoma

BY FRANK C. HUDSON

The Tacoma, Wash., shops of the Chicago, Milwaukee and St. Paul Railway are particularly interesting because of the fact that this road uses electric locomotives on long runs and over heavy mountain grades. These locomotives are over 100 ft. long and cost over $200,000 each. But the motive power officials are enthusiastic over their performance.

The electric locomotive brings entirely new problems to the railway repair shops, involving the need of men who understand electric motor work such as winding armatures, caring for commutators and the like. But electric motors require much less attention than their steam-driven predecessors and a general overhaul can be made in about one-third the time formerly required. This is partly attributable to the absence of reciprocating parts in the transmission of power. The substitution of rotary motion eliminates the pound on the wheel bearings and entirely does away with the wear on main and side rod bearings. Another noticeable effect is the reduced wear on driving box thrust-plates and hub-liners, the life being increased from 50 to 100 per cent over that of the steam locomotives. The first cost of the electric locomotive is, of course, very high at the present stage of development but the power which can be obtained is largely in excess of the largest steam locomotive on the road, while the increased service and the decreased cost of repairs count very largely in their favor.

The electric locomotive is introducing a new phase in railway repair shop practice which may in time change the whole complexion of the railway shop.

Controlling Costs in Building Experimental Machines

BY FRED H. COLVIN
Editor, *American Machinist*

The third article showing records kept—How engineering changes are recorded—Stock lists and a complete record of costs of all departments

AN IDEA of the way in which parts lists are kept according to kind may be had from Figs. 15, 16, 17 and 18, which show portions of large blueprints, about 16x24 in. Fig. 15 shows screw machine parts, some of which afterward have gear teeth cut in them, and it will be noted that all parts of a similar diameter are grouped together. Punchings are shown in Fig. 16. The table gives the thickness of stock, the kind of operations and number of the tool. The sketches help to make each part clear to everyone who handles them. The parts made of similar stock are grouped together as in the other lists. Castings are given in Fig. 17, only a portion being shown. This list shows the kind of casting, the number and the operations on each. The metal is cast iron unless otherwise stated and jigs are used or suggested in many places. Fig. 18 shows some of the purchased parts and is a good guide for the stock-room man and for all who handle these parts.

CONTROL OF SHOP PARTS

In addition to the ordinary bookkeeping record, there are special records, such as operation sheets for every part; tool and machine material sheets with a complete list of standard and special tools and inspection instruction sheets. Job cards are filed according to part numbers and a time record of every job in the shop is kept. There is also a recapitulation cost sheet, which gives the total cost of the part, whether partly made outside and finished in the shop, or made on several different production orders. All records show time consumed, and also actual cost. On issuing an order to the shop, the following entry is made in a production order book:

Order No.	Part No.	Date	Part Name	Oper.	No. Pcs.	Estimated			Pcs. Fin.	Actual			
						S. U.	Mach.	Total		S. U.	Mach.	Total	Appvd.
2,013	1,009	3/10/21	Stud	Drill	125	05	55	1	125	05	40	45	JD

This form shows the management at a glance whether the shop supervisor and production man are on the job. It tells whether or not estimates were correctly made and if the time consumed on each job has been investigated. Referring to the entry in the production order book, it will be seen that it compares the estimated and actual time of each operation. Moreover, it shows the spoiled work, if any, by noting the difference between the number of pieces in the sixth column and the number of pieces finished, which follows the estimated time.

It will be noted that the SU, or set-up time, was 5 sec. in each case, but that the actual machining time took but 40 sec. instead of 55 sec., as estimated. The total time was thus reduced from 1 min. to 45 sec. The initials under the last or approval column show that this has been checked by the inspector.

A tool register is kept, in which all tools are illustrated as in Fig. 19. The picture drawing shows at a glance just what the tool is. The tools are given the same number as the parts for which they are used, so as to assist in finding at once sketches or tools for the various parts. The following stock-room records are also kept. Perpetual inventory cards; requisitions on stock room, receiving slips filed alphabetically according to seller, and daily receiving sheets. An order from the Assembly Department would read as follows: Requisitioned 5 times PA 2,200. This denotes that they want to assemble 5 units shown on assembly drawing No. 2,200. In spite of the fact that this assembly contains 43 individual parts, one stock-room man can take care of the entire assembly department because the parts are put away according to assembly and are kept together in predetermined drawers.

There are over 500 assemblies in the complete machine. In most cases, there are very few assemblies to

Gears (Screw Machine)					Shoulder Studs ($\frac{7}{16}$"–$\frac{3}{4}$" stock. C.R.S.)						
Sketch	Part No.	Req. for Mach.	Stock Size	Length per Piece	Sketch	Part No.	Req. for Mach.	Stock Size	Leng. per Piece	Extra Oper.	
	4180	5	1 3/4	0.875		5506	5	7/16	0.437	File	
	4164	5	1 3/4	0.375		7935	2	1/2	0.125		
	7173	1	1 3/4	1.625		2775	50	1/2	0.375	Drill	
						5335	5	1/2	0.375	Drill	
						9021	105	1/2			
	4405	5	2 1/16	1.000		5498	5	1/2	1.437		
	5019	5	2 1/16	0.625							
	5022	5	2 1/16	0.625		2233	10	5/8	0.453	Drill	•
						2506	10	5/8	0.344	Drill	
						2518	5	5/8	0.312		
	5074	5	2 1/8	0.375		2746	5	5/8	0.219		
	5073	5	2 1/8	0.375		2766	5	5/8	0.375	Drill	
						2868	10	5/8	0.250		
	4132	5	2 1/4	0.375		3071	5	3/4	0.625		
	4163	5	2 1/4	0.937		3160	5	3/4	0.312		
						3166	5	3/4	1.625	Drill	

FIG. 15—SCREW MACHINE STOCK PARTS

Punchings

Sketch	Stock	Blank	Pierce	Bend	Shave	Drill	Req.
9387	0.045	Die 9387		Die 9387-3		Jig 9387	165
9254	0.063	Die 9254-1		Die 9254		Jig 9254-3	165
9255	0.063	Die 9255		Die 9255		Jig 9255-2	165
9262	0.063	Die 9262					330
9294	0.063	✓	✓				165
9299	0.063	Die 9299-1					165
9706	0.063			✓		✓	10
9707	0.063			✓		✓	5
1057	0.063	Die 1057	Die 1057	Die 1052-2			125
1058	0.063	Die 1058					1410
1062	0.063	Die 1062	Die 1057				125
9011	0.063	Die 9011		Die 9011			165

Sketch	Stock	Blank	Pierce	Bend	Shave	Drill	Req.
9216	0.125	Die 9216				Jig 9216-2	165
9218	0.125	Die 9218-1					165
9219	0.125	Die 9219-1					165
9228	0.125	Die 9226	Mill Fix. 9228-3	Die 9228-2			165
9258	0.125	Die 9258					165
9503	0.125	Die 9503	Die 9503				40
9506	0.125						80
9535	0.125	Die 9535				Plate 9535	120
9536	0.125	Die 9536				Jig 9536	120
9684	0.125	✓			Mill Fix. 9684		240
9205	0.125	Die 9205		Die 9205-2		Jig 9205	330
9206	0.125	Die 9206				Plate 9206	165
9207	0.125	Die 9207	Die 9207				165
9209	0.125	Die 9209-1		Die 9209-2		Jig 9209	165

FIG. 16—LIST OF PUNCHINGS USED

be made at one time and, if the men were allowed to go to the stock room to collect the parts needed, much valuable time would be consumed. Therefore, the parts in the stock room for a certain number of machines are kept in separate drawers, each drawer or set of drawers corresponding to a PA. Consequently, it is easily possible at any time to look at a PA print and find out, by opening a few drawers, how many parts for

Sketch	Mill	Drill	Broach	Disk Grind	Lathe	Shape	Req.
Alum. 4052		✓			✓		5
4056	✓	✓					5
4057	✓	Jig 4057-2					5
4063	✓	Jig 4063-1A					5
Bronze 4084		✓			✓		5
Bronze 4085		✓			✓		5
4086		Jig 4086-3			✓		5
Alum. 4091		Jig 4091-1			✓		5
Alum. 4092	✓	✓					5
4095	✓	✓					5
4101	✓	✓					5
Alum. 4103	Fix 4103	✓	✓				5
4104	Fix 4104-3	Jig 4104-2					5
4133		Jig 4133-2			✓		5

FIG. 17—THE CASTING PARTS LIST

any sub-assembly are on hand and what is missing. Flat drawers on steel racks, divided into small compartments which can be subdivided if desired, are used for this purpose.

The location and quantity of parts in these drawers are controlled by perpetual inventory cards, the location being predetermined by a permanent and complete record of all prints. In case of large parts, a card with a sketch of the part is put into the compartment, while the part itself is placed on a large shelf and recorded on stock cards. When it is decided to put together any sub-assembly, the stock room man gets an order to prepare parts for certain PA's. Once put to work, the assembly man does not need to leave his desk, as all the riveting, spinning or welding has been done before the parts reach him.

Blueprints and drawings are controlled in a similar manner. A numerical book, which files all blueprints, is kept for reference. Each unit also has an individual file book containing PA prints, assembly prints and detail manufacturing prints. The detail prints are grouped in accordance with the assembly, so that details covering any one sub-assembly or assembly are always together.

Engineering changes are suggested by the shop or Engineering Department. In both cases, the form below is filled out, after marking necessary changes in the reference book and attaching a corresponding blueprint to the report.

DAILY SHEET OF ENGINEERING CHANGES

Date: 3/4/22. Sheet No. 12

Part No.	Issue No.	Issue Date	Issue Check By	Nature of Change	By	Approved By Prod.	Changes Made Date	Changes Made By Whom	Changes Made Check By	Investigated Date	Investigated O. K. By
3,009	3	2/4	M J B	Drill $\frac{1}{4}$ in. hole $\frac{1}{4}$ in. from small end as noted on print.	J W	A E B	3/5	F R	A B	3/6	E A K

Each day the above records of changes suggested are sent to the chief draftsman, together with the marked prints. In this way, confusion is prevented because no print is given out for manufacture until the reference file has been consulted and found that no changes are pending. This gives an automatic control over pending changes. It also shows who made the changes and who approved them.

Records for the Management

It is Mr. Gehring's belief that there is no necessity for the manager to use a scratch pad for analysis. For his personal use, he has compiled a daily shop report which shows at a glance just how many hours were spent on production work, how many hours on temporary or non-production work, the number of tool hours, and other overhead. Each week these reports are compiled into a weekly average report, giving the management a bird's-eye view of what is going on in the shop and showing also for what purpose money is being expended. It also indicates the complete overhead. The production book shows at all times whether or not the estimates are correctly made, what work is in the shop, and just how efficient it is.

Miscellaneous (Pur)

Sketch		Size	Length			Req.		
Johnson	7485					1		
Johnson	7486	No. 0				1		
Yale & Towne	7505					1		
Flange	7326	1"x 4"				12		
Mesh Wire	7822	30"x31"x1"				1		
S.K.F.	4245	No.1201				2		
S.K.F.	4247	No.1200				1		
S.K.F.	7477	No.1205				1		
S.K.F.	7034	No.1204				13		
Wood	7137					30		
Wood Screw	7132	No. 5	7/8"			24		
Wood Screw	7408	No. 6	1¼"			49		

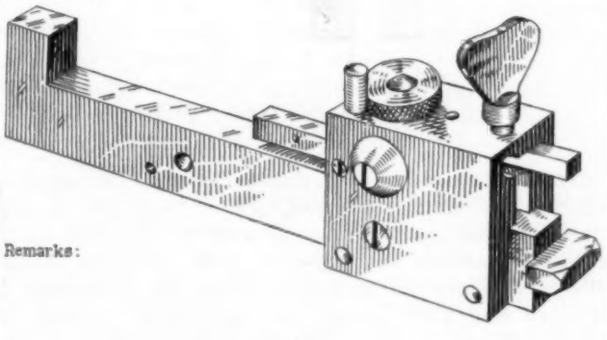
FIG. 18—THE MATERIAL PURCHASED

As soon as a part is completed by the shop, the time consumed is entered on the PA, of which the manager has a complete set. When a sub-assembly is completed, the items are totaled and he can easily check the cost of any sub-assembly, assembly or unit, and compare them with previous costs. With such a policy, it is a comparatively simple matter to build quite a number of special machines simultaneously without creating confusion in the shop, assembly department, stock room, or any part of the plant.

NAME OF PART: *Hollow Milling Fixture* PART NO: *9513* ORDER NO: DATE: *7-3-21*

TOOL NO: *T-1-9510-A-1*

Order No:
Est. Del:
Ent. on Ledger:
Ent. on Oper. Sheet:



Remarks:

	Designed			Pattern			Casting		Tools			Est.	Actual
	Date Drwg.	Date chck.	Date Ord.#	Date Ord.	Date Rcvd.	Date chck.	Ord. No.	Date	Ord. No.	Date	Insp.	Hrs.	Cost

Tool form (3/7/22 Stenc.) EAK

FIG. 19—A LEAF FROM THE TOOL RECORD

As soon as a part is completed by the shop, the time consumed is entered on the PA, of which the manager has a complete set. When a sub-assembly is completed, the items are totaled and he can easily check the cost of any sub-assembly, assembly or unit, and compare them with previous costs. With such a policy, it is a comparatively simple matter to build quite a number of special machines simultaneously without creating confusion in the shop, assembly department, stock room, or any part of the plant.

The records described are such that full information concerning any part is always available. They show the time consumed in making the parts, sub-assembly or units and also the total cost of the part at the same time. The actual labor in time is also included so that the information is equally valuable regardless of the wage rates which may prevail.

All of these reports doubtless seem formidable to anyone not familiar with them, and the question of cost undoubtedly looms large in the minds of many readers. As previously mentioned, the cost is considerably lower than might be imagined and this is borne out by the table shown in Fig. 20, which gives the various items entering into the average cost of production over a 60-day period at the time when labor was very much higher than at present. Fig. 20 is well worth careful study, both for the facts revealed and for the compact method of recording so many essential items bearing on the cost of production.

With the number of employees ranging from 30 to 38, and direct labor from 83 to 94 cents per hour, the total hourly cost, as well as comparatively low overhead and its distribution are of particular interest. The direct labor charge is high, because men were building tools at the same time, which was at the highest point

AVERAGE COST OF PRODUCTION

Week Ending	Department							Rate Per Hour	Total Payroll	Direct %	Indirect %
	No. of Empl.	Direct Labor	Shop Super	Production	Stock Room	Office	Drafting				
Sept. 15, 1920	37	$ .88	$ .17	$ .05	$ .04	$ .08	$ .16	$1.38	$985.39	63.5	36.5
" 22, "	35	.86	.11	.09	.04	.04	.14	1.28	961.85	67.3	32.7
" 29, "	38	.85	.09	.10	.05	.04	.12	1.25	974.83	68.1	31.9
Oct. 6, "	34	.86	.09	.10	.05	.04	.10	1.24	871.52	69.3	30.7
" 13, "	33	.88	.07	.13	.06	.05	.11	1.30	827.96	67.7	32.3
" 20, "	30	.88	.07	.13	.06	.04	.10	1.28	909.17	68.6	31.4
" 27, "	34	.86	.06	.16	.05	.05	.09	1.29	1141.81	66.5	33.5
Nov. 3, "	34	.83	.13	.16	.04	.05	.09	1.30	698.08	64.0	36.0
" 10, "	36	.92	.06	.14	.03	.04	.08	1.29	2080.43	71.3	28.7
" 17, "	36	.94	.06	.11	.03	.03	—	1.17	2251.86	80.0	20.0

FIG. 20—A SUMMARY OF COSTS

in labor prices, toolmakers running from $1 to $1.25 per hour. The cost of the records, however, can be easily estimated when it is stated that at no time did the clerical force of the establishment *exceed one man and two girls*. Obviously, not all of their time could possibly be spent on records.

In view of the nature of the work, the comparatively small lots in which everything had to be manufactured and other handicaps, a careful study of the methods employed should be of value to every manager of the experimental and development departments of large concerns and give the individual inventor a great deal to think about. The financial backers of many an enterprise can greatly benefit by insisting that similar methods be followed and save many useless expenditures.

Manufacture of Hardware, 1921

The Department of Commerce announces that the value of products of establishments engaged primarily in the manufacture of hardware amounted to $116,689,000 in 1921 as compared with $154,525,000 in 1919 and $73,320,000 in 1914, a decrease of 24 per cent from 1919 to 1921, but an increase of 59 per cent for the seven-year period 1914 to 1921.

Transmission of Power Through Ball Friction Gearing

By Carl G. Nordstrom

FRICTION gears as generally used imply great and unbalanced pressures on the bearings. In spite of this drawback they are in common use, and thousands of horsepowers are transmitted through such friction wheels as the driving wheels of locomotives and the rollers of mills. Many attempts have been made to transmit power at reduced or increased speed by means of friction wheels arranged as a planet gear, which has the advantage of balanced pressures on the bearings.

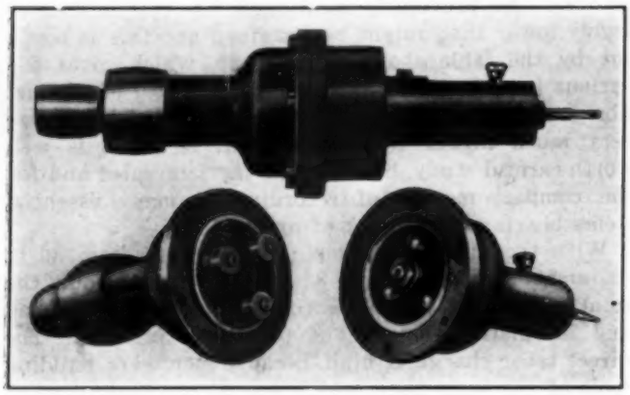


FIG. 1—HIGH-SPEED GRINDING SPINDLE HAVING BALL FRICTION GEARING TO INCREASE SPEED

Such gears have been tried with friction wheels of cylindrical, conical and spherical shape, but so far none of them seems to have been commercially successful. Their efficiency was too low, usually less than 80 per cent, thus resulting in heating and wear.

An improvement in the efficiency of such gearing is obtained by shaping the friction wheels as complete spheres, using ordinary steel balls, and by arranging the gearing as shown in the accompanying illustrations. This construction was developed and patented in Sweden

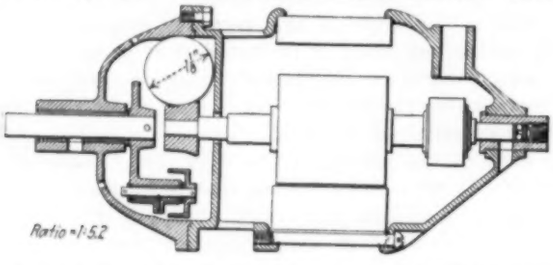


FIG. 2—BALL FRICTION GEARING ON SMALL MOTOR

by Gustaf Rennerfelt, who is represented in this country by the author, whose office is at 30 Church St., New York, N. Y.

A spindle for high-speed grinding in which is incorporated the speed-changing mechanism is shown in Fig. 1. The positions of the balls and the rollers bearing on them can be seen in the view showing the housing opened. The arrangement employed when mounting the mechanism in the housing of a hand portable tool such as a drill or grinder, is shown in section in Fig. 2. This type of transmission can be used for either reducing or increasing the speed. Ratios as high as 8 to 1 are practicable, and even more for small powers. The ratio, of course, is not a variable one, but is constant for each particular device.

The balls are three in number and serve as a ball bearing of the two-point type for the high-speed shaft, the balls being pressed between an outside race and a pinion fastened to the shaft. The low-speed shaft carries a yoke in which are journaled three rollers that make a rolling contact with the balls, and transmit the pressure between the yoke and the balls. The journals of the rollers are automatically lubricated by oil contained in the casing of the gear. The necessary pressure between the balls and the pinion is obtained by an axial thrust on the high-speed shaft, caused by a spring, a weight or by other means.

Gears of this type have an efficiency of 95 per cent or more, and are applicable to many purposes where a small power is to be transmitted at reduced or increased speed; for instance, electric motors with torque less than 60 in.-lb., centrifuges, spindles in cotton mills and various tools. In order to prevent slip at an overload the pressure on the balls is always adjusted for transmission of three times the normal torque. Very satisfactory dimensions of the gear are obtained with smaller specific strain on the balls than is the case in ball bearings as commonly used.

With the gearing applied to an electric motor as in Fig. 2, the pressure on the balls is obtained from

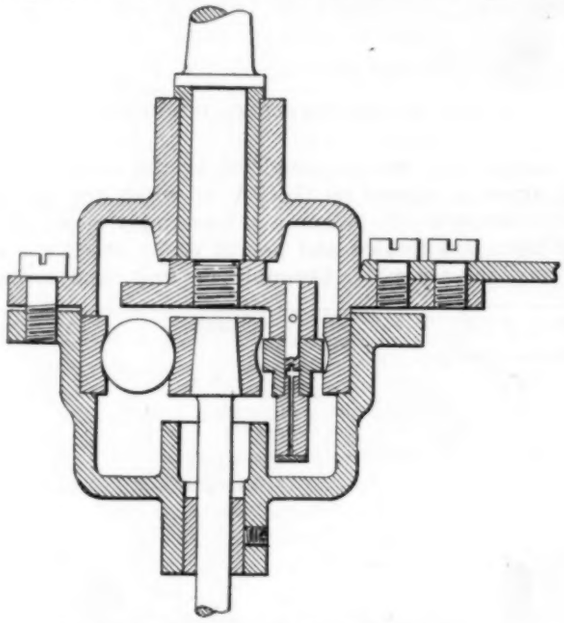


FIG. 3—VERTICAL SPINDLE WITH BALL FRICTION GEARING

a spring at the end of the armature shaft. The application of the gear to the grinding spindle shown in Fig. 1 is for grinding small holes at a speed of 50,000 r.p.m. In this apparatus the required axial pressure on the balls is obtained automatically when the apparatus is fed back and forth along the piece being ground, by reason of the friction between the work and the abrasive wheel carried on the spindle. During the grinding operation the balls will make contact with the outer race alternately on either side of its middle plane. The pressure between the balls and the pinion will therefore cease every time the feed changes direction, and consequently the speed of the abrasive wheel will be decreased or stopped when the latter is at the end

of the hole. This apparatus therefore possesses the unique feature that it does not grind the ends of the hole larger than its middle. It is capable of driving without slip an abrasive wheel of more than half the diameter of the pinion.

The device shown in section in Fig. 3 is similar to Fig. 1 in that the spindle is not loaded by spring pressure, but by the action of the tool it carries. It is

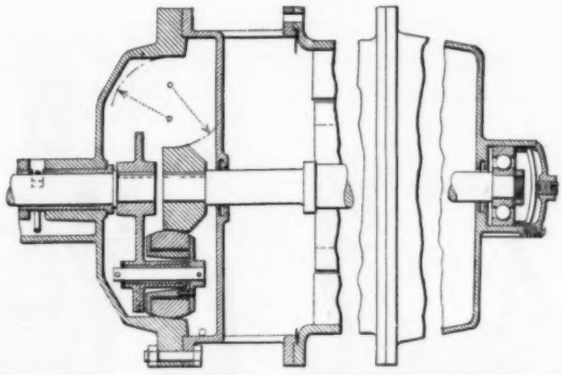


FIG. 4—BALL FRICTION GEARING ON 20-HP. MOTOR

intended especially for drilling and is arranged so far as lubrication is concerned to operate in a vertical position.

The maximum capacity of the gearing as stated earlier in this article is for installations using standard balls. There are, however, possibilities of accomplishing more difficult work by using special balls. Fig. 4 shows a friction gearing mounted on a 20-hp. electric motor, the speed of which it reduces from 1,250 to 400 r.p.m. The ball is 5¾ in. in diameter, has the form of an annulus cut from a sphere, and is mounted so that it can adjust its position to the races. It should be noted that the housing forms the outer race, that there are no rollers bearing on the balls in this case, and that the mechanism is quite compact.

The Outlook

BY A. E. INGHAM
In *British Machine Tool Engineering*

THE engineering industry has recently passed through such a nightmare of adversity that to write or speak of a general recovery of trade is, in some quarters, to be accused of being the premature victim of an impossible optimism.

International unrest, agitation at home and the scourge of taxation have brought about adverse conditions of trade and unemployment unprecedented in the industry.

The adverse conditions of trade and low prices quoted in an endeavor to stimulate it, have touched the bottom and hence must rise. The turning point has been passed and the vista now broadens and brightens. It is therefore up to all who have the interests of the industry at heart to lift up their eyes with confidence to the future, and with courage and energy, help to bring about that permanent recovery which only combined effort and constant co-operation can accomplish.

We are at last in sight of the restored intercourse of peoples bound now to join in common effort on a wider and wider scale for the political settlement and economic recovery of civilization.

The grave question of tremendous adjustment of wages without catastrophic troubles has been settled and the relations between capital and labor are once more on a tolerable basis and adjusted to harsh realities. In consequence, costs and prices are down to the minimum economic limit and conditions preeminently favorable to the buyer.

The cost of labor and material being common to all manufacturers, any credit balance in excess of competitors can be secured only by improved methods of production. It should, therefore, be the aim of all manufacturers to set their works in order by adopting most modern machines and methods of production and thereby sharing to the fullest possible extent the fruits of a real trade revival, and incidentally helping to speed up the time when this will be an accomplished fact.

LACK OF INITIATIVE STILL EXISTS

The supreme indifference to modern designs and methods of production is a most disappointing feature in many engineering works and particularly to those whose duty it is to endeavor to alter such conditions.

Improvements that do not come when they ought, will come when they must. This is generally too late, and no power is so drastic as the compulsion of circumstance. Firms who have adopted delay and apathy ultimately find that some one more enterprising and alert has been at work to their disadvantage. As opposed to this attitude, a remark recently made by the works manager of one of the premier railway companies in this country to a representative of the A. B. M. T. M. is worthy of note. He stated: "If a new machine is introduced, which is an improvement on machines now installed in our works, and about which I am not fully informed, I shall take it as a personal grievance." It should not for one moment be imagined that (particularly in present conditions) railway companies have unlimited reserves to draw upon, and that the question of a machine is a mere detail. Actually an elaborate balance-sheet is compiled on which is shown "Profit on investment" and "Percentage saving on old prices," based on guaranteed production times furnished by machine tool makers. The approval of the chief mechanical engineer is given when it is proved that a new machine pays.

It is unfortunate that all engineers are not open to conviction and do not appreciate the possibility of modern methods. It should be realized that the best is the cheapest in the long run and also that it is less costly to maintain a good machine than to suffer from a poor one.

MUST SECURE LOW PRICES BY SPECIALIZATION

It is only by concerted effort in national and individual interests that British supremacy in engineering can be maintained.

We all live by successful selling at a competitive price in the markets of the world. To do this, we must produce the best possible article at the lowest possible price, an accomplishment which can be maintained only by specialization and concentration. It is therefore up to each member of the industry to do his utmost to create business and discard obsolete methods without delay. Accomplishments are milestones on the road of progress, and collectively and interdependently we can help to re-establish the great industry of engineering to its former prosperity and still further improve "The Outlook."

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

Two Home-made Machines in an Arizona Shop

BY I. B. RICH

The shop of Kunz Bros. & Messinger at Phoenix, Ariz., handles about anything that comes along in the way of repairing machines. Irrigating pumps, oil or gas engines and almost anything else are all in the day's work. Some of the work requires cutting keyways on good sized shafting and not having a good machine available, the keyseater shown in Fig. 1 was built in the shop.

This machine is fairly husky, being built up of channel-steel beams mounted on cast iron legs, and carrying a head with the cutter spindle as shown. The head consists of four vertical guide bars which are fastened

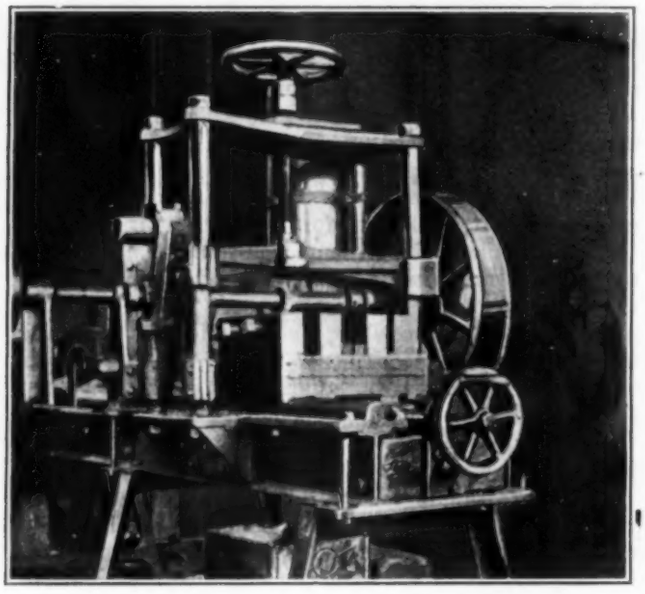


FIG. 1—A 7-IN. KEYWAY CUTTING MACHINE

to the channels by the brackets shown. The vertical movement of the cutter is by the central screw, which raises or lowers the head on these guides.

The work is held in the substantial vise shown at the front of the bed, the lengthwise feed being secured by the hand wheel in front. The spindle is driven by the pulley shown. Shafting up to 7 in. in diameter has been key-wayed in this machine.

Another and more pretentious home-made machine is the hydraulic press shown in Fig. 2. The upper ends of the ram and the support are set behind the center line so that the crane can easily handle large work right into the very center of the machine without having the upper rail interfere in the least.

The press is very conveniently arranged with hand wheel traverse for the outer support and the multi-cylinder hydraulic pump is convenient of access. Pressures up to 190 tons have been secured with this machine so that it cannot be considered amateurish in any way. Both machines are very creditable pieces of work.

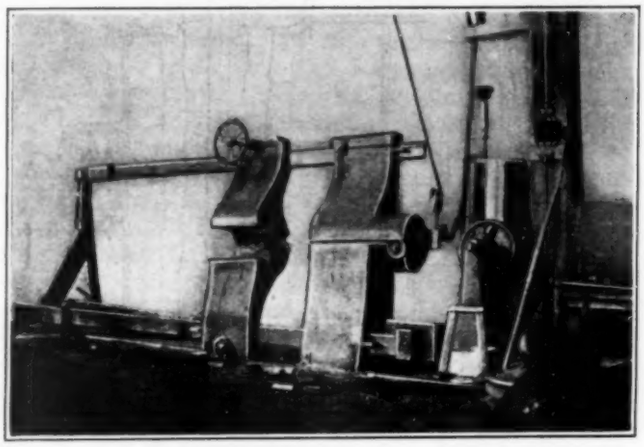
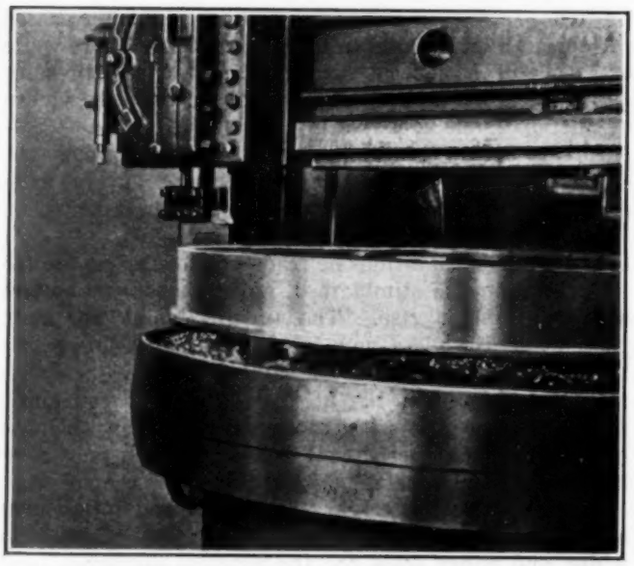


FIG. 2—LARGE HYDRAULIC PRESS

Keeping the Floor Clean Around the Boring Mill

BY CLAYTON C. CLARK

The accompanying illustration shows a scheme for keeping the floor clear of chips around a vertical boring mill. The revolving table of such a machine scatters the chips far and wide, and when the material being machined is steel the condition of the floor surrounding the machine is not conducive to the comfort of the operator. If brass or bronze is the material



DEVICE TO KEEP CHIPS ON THE BORING MILL TABLE

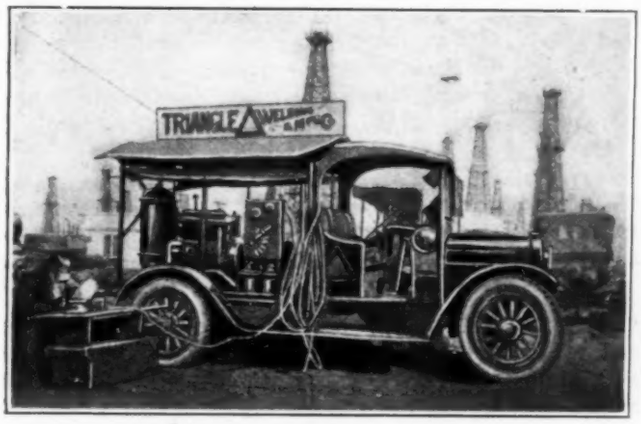
being worked upon, this device helps to keep the chips separate from less valuable scrap until the machine is ready to be cleaned up and the chips deposited in their proper receptacle.

Take a piece of old belt about 6 in. wide and long enough to go around the circumference of the table, and lace or otherwise fasten it in place as shown in the picture. If the belt is 6 in. wide it may be allowed to project 2, or even 3 in. above the table surface and thus form a flange clear around the table that will effectively prevent the chips from being thrown off. When it is time to clean off the table, or at any time the flange is not wanted, simply push the belt down until the upper edge is flush with the table surface. If laced sufficiently tight the friction will hold the belt wherever it is placed and it is never in the way.

Portable Welding Outfit in Los Angeles Oil District

BY FRANK C. HUDSON

The accompanying illustration shows how repairs are made right in the oil fields. Here is a truck with a portable arc welding outfit consisting of a gasoline motor, generator and all other necessary apparatus.



PORTABLE WELDING OUTFIT

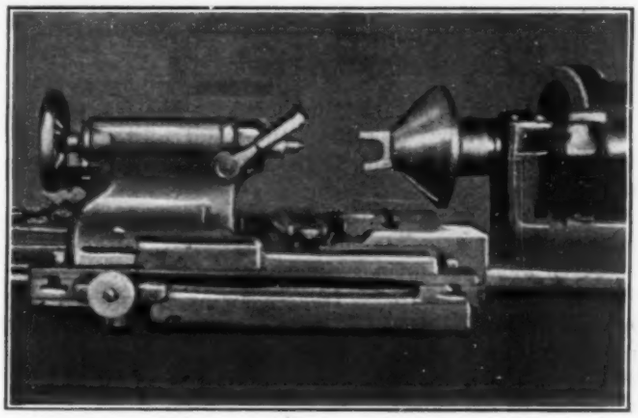
The operator has the rotary bit, on which he is working, laid on the improvised bench at the left. In this way, welding is done while you wait, and you don't wait long either. The worn edge of a cutting disk is being built up in this case.

Preventing Distortion in Pistons

BY HERBERT CRAWFORD

This little trick in preventing distortion in light pistons came from the shop of the Arizona Machine Company of Phoenix and is credited to F. T. Lyon who looks after most of the automotive work. The only difference between the ordinary driver and the one shown is that this one is forked instead of being solid, but that's the secret.

The piston is centered on the upper or head end and the open end of the skirt finds its center on the cone. The fork or driver goes up between the piston pin bosses as usual. When the piston is light, as is fashionable these days, it was found that the action of the driver against the bosses tended to strain the piston so that it was out of round when the cutting stress was removed. Not much to be sure, but enough to be noticeable where a really nice job was wanted.



DRIVER WHICH FITS OVER PISTON PINS

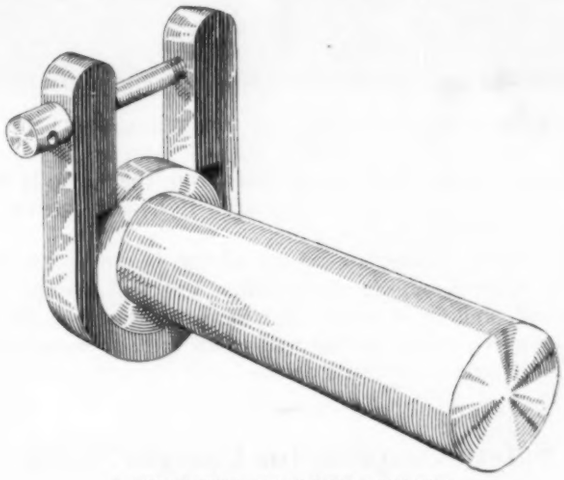
The next step was to cut away the center of the driver so as to fit over a piston pin, and a pin is always in place while the piston is being turned. This stiffens the piston by holding the bosses in line during the turning operation and a much better job is secured.

A Thin Work Driver for the Lathe

BY HARRY MOORE

The sketch shows a thin work driver, or dog, for use in the lathe when turning short pieces that must be finished very near to the end. It was devised for the purpose of turning some brass pins having $\frac{3}{8}$-in. heads and the stock was cut off leaving just sufficient material to face both ends.

The driver is made of $\frac{3}{8}$x$\frac{1}{4}$-in. stock and bent as shown. One side is tapped for the tightening screw and the hole in the other side is made somewhat larger than the diameter of the screw to prevent the latter from cramping.



A THIN DOG, OR WORK DRIVER

The corners of the driver bite into the softer material of the work and provide a very tight grip.

To load the work into this driver the driver is laid flat on a bench plate and the work set in vertically until the end just touches the plate, when the screw is tightened. A stud bolt in the faceplate serves to rotate the work, and should not project beyond the driver.

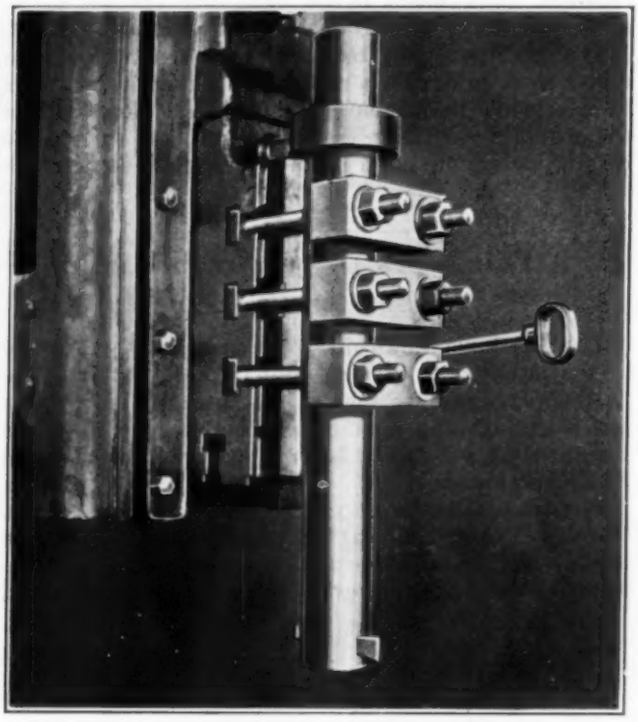
A Tool Bar for the Slotting Machine

By Amos Ferber

A tool bar for the slotting machine that carries its own "clapper box" to relieve the point of the tool on the up-stroke of the ram, is shown in the accompanying illustration.

The bar is of mild steel. It is slotted at the lower end to receive the swinging tool holder of hardened steel, so mounted upon a fulcrum pin passing through it and the bar as to be free to swing downward and backward but is limited in its upward and forward movement by a stop, in which position it corresponds in shape and diameter to the bar and is to all appearances an extension of it.

The location of the fulcrum pin is such that the pressure of the cut on the down stroke of the ram holds the swinging piece firmly against the stop, while as



TOOL BAR FOR THE SLOTTING MACHINE

the point of the tool drags back over the work it has only to overcome the tension of a light coil spring in order to relieve itself.

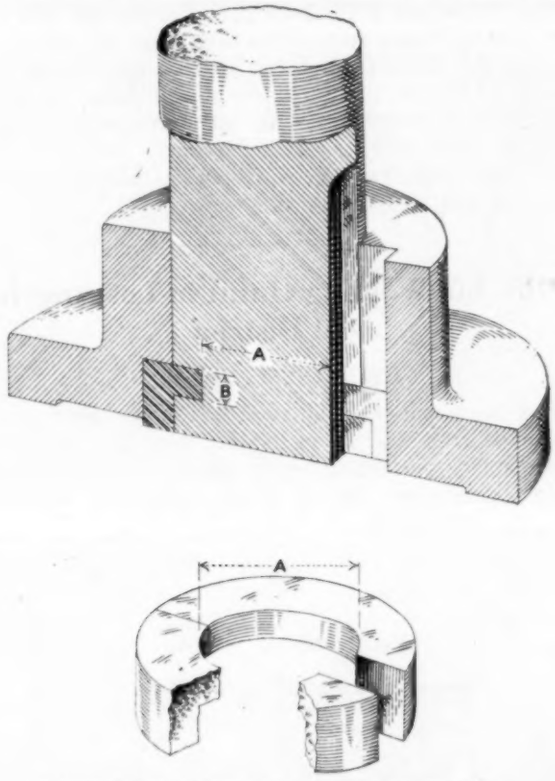
The collar at the upper end of the bar prevents the latter from dropping down when the tool clamps are released, and is of great assistance to the operator in replacing or resetting the tool when for any reason the bar is taken out of the machine.

Safety Coupling for Upright Shafts

By John A. Yungwirth

In paper mills there are many upright shafts used in connection with water wheels and it sometimes happens that the couplings on such shafts will work loose and allow the entire weight of the shaft and attached parts to fall upon the step bearing of the wheels. In one such case that came under my observation recently, this condition obtained and escaped notice until the coupling separated from the shaft and the wheel was broken beyond repair.

In making the new shaft and connections for replacement, the maintenance man at the mill devised a safety lock between shaft and coupling that will positively prevent a recurrence of this trouble. The coupling is counterbored as shown in the sketch and the shaft has



SAFETY COUPLING FOR UPRIGHT SHAFTS

a square groove cut in it having the bottom diameter *A* and width *B*. A steel collar is made as shown in the section and is then split in halves lengthwise, with sufficient space cut out for the key.

To assemble the parts the coupling is driven on the shaft until the face is beyond the groove. The split collar is then fitted in place and the coupling driven back until the counterbore bottoms upon the collar, when the face of the coupling is flush with the end of the shaft.

The key is then driven in place, filling the space left in the collar. If all the parts are well fitted, the job is as solid as if fitted in the ordinary way and there is no possibility of the coupling getting out of place.

Piston Inspection Gages

By Frank C. Hudson

The methods used by the Pierce-Arrow Motor Car Co., Buffalo, N. Y., in inspecting pistons are particularly interesting from several angles. The inspection operations shown include the thickness of the piston wall which affects the concentricity and equal distribution of weight, the thickness of the head, the distance from the inside of the head to the end of the skirt, and the depth or diameter of the groove in the pin hole.

The gage for inspecting the thickness of the cylinder wall is shown in Fig. 1, and consists of a base or standard *A* carrying a central arbor *B* and an overarm *C*.

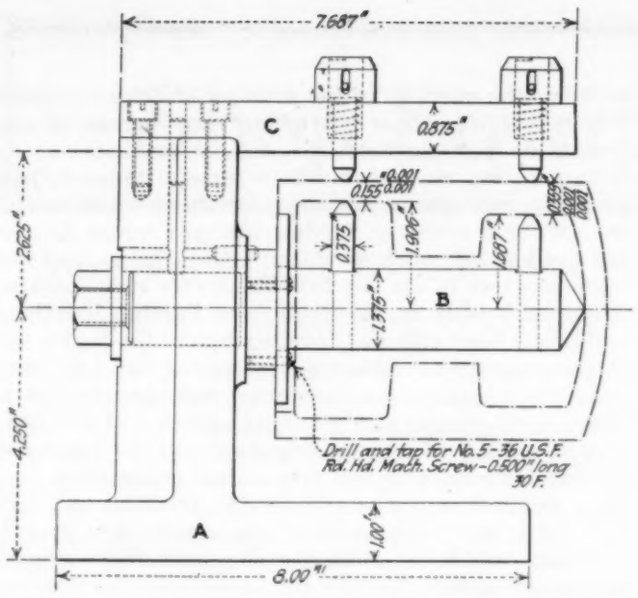


FIG. 1—GAGE FOR THE WALL THICKNESS OF PISTON

The arbor *B* carries two fixed pins of the proper length to support the piston on the two inside diameters shown. The overarm *C* carries two spring plungers opposite the fixed pins in *B*. The pins are set to the proper dimensions and both plungers and bushings are ground flush to act as flush-pin gages, as the plungers will only be flush when the piston thickness is correct.

For testing the thickness of the piston head, the gage shown in Fig. 2 is used. This gage has a pin *A* mounted in an upright on the base *B*, which is in reality a large V-block of the proper size. The gaging is done with a spring plunger of the flush-pin type, in the arm *C*. The arm *C* is pivoted at *D* so as to be readily swung out of the way when inserting or removing a piston.

A third gage, also of the flush-pin type, but without a spring in the plunger, is shown in Fig. 3, and is for gaging the distance from the base of the piston skirt to the inside of the head. The flat crossbar *A*

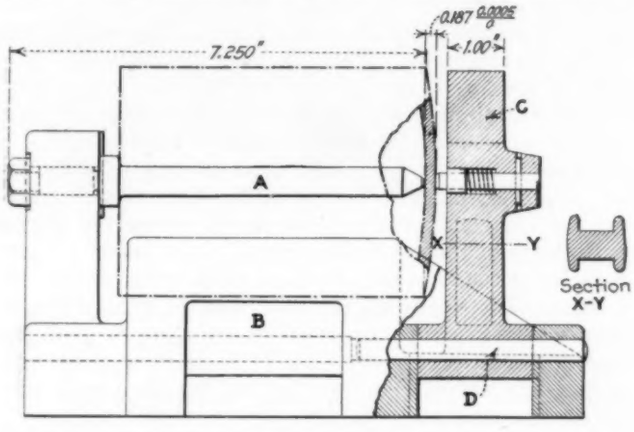


FIG. 2—GAGE FOR THE THICKNESS OF PISTON HEAD

is turned with shoulders on the ends to fit inside the bore and across the end of the skirt, as shown. The gaging rod is shown at *B*, and is free to move endwise within the distance allowed by the difference in diameter between the hole in the crossbar and the pin in the rod as seen at *C*. The rod is simply a piece of $\frac{3}{8}$-in. drill rod with one end pointed and rounded, and the other end provided with an offset which gives a total tolerance of 0.004 in., divided equally between plus and minus.

An ingenious gage for checking the diameter of the groove which is cut in the outer end of the piston-pin hole is shown in Fig. 4. This groove holds the retaining ring at the outer end of the floating piston pin

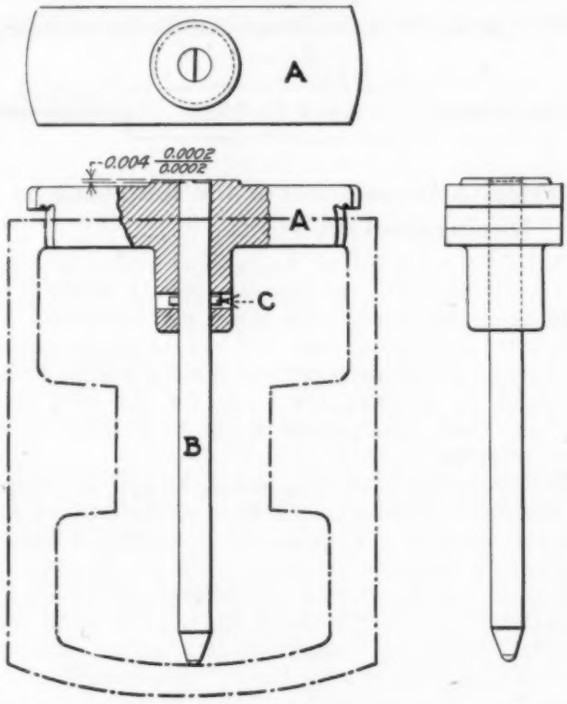


FIG. 3—GAGE FOR THE INSIDE DEPTH OF PISTON

and prevents it from working out against the cylinder wall and scoring it. The body of the gage *A* has a projection *B*, which forms one of the measuring points. The body also carries the plunger *C*, which is prevented from turning by the pin shown, and which has the gaging head *D* on its outer end. This gage is used in the hand, the thumb and one finger compressing the spring shown and bringing the gaging points together so that they can be slipped inside the piston-pin hole and

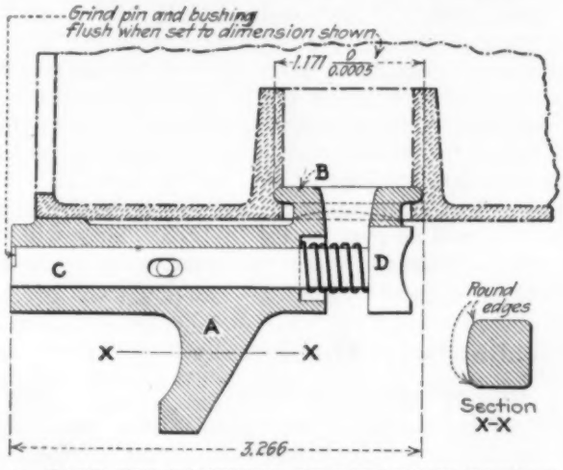


FIG. 4—GAGE FOR DIAMETER OF RETAINING GROOVE IN PISTON-PIN HOLE

allowed to expand into the groove. The end of the plunger is ground flush with the body *A*, and also has a step which gives the tolerance desired. A gage of this form can readily be made for many modifications of measurements of this kind.

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN
Editors

April 19, 1923

Physical Achievements of the Railroads During the Last Year

CONDEMNATION of the railroad managements for every sin in the calendar is a popular pastime both with those luminaries who grace our legislative halls and with certain editorial molders of public opinion. If some of the condemners would show a little breadth of vision by praising the roads for the good things they do, their fulminations might be listened to with more attention.

The record of railroad accomplishments as compiled by the public relations committee of the eastern roads has just come to our notice and is worthy of mention. Most of us have seen too much of the effects of the coal and shop strikes on the roads with which we are most familiar to question the harm they did to the roads in general. Under such conditions it is rather remarkable that the car loadings for the last six months of 1922 were less than one per cent below those of the corresponding period in 1920, the high point in railroad history.

The reduction by twenty-five per cent of the number of bad order locomotives between September 15 and February 15 is an outstanding achievement when one considers the after effects of the shop strike and the hopelessly inadequate and archaic equipment of the average railroad repair shop.

According to the bulletin the purchase of 136,718 freight cars, 2,709 locomotives and 2,382 passenger cars constitutes the largest single addition to railroad capacity since 1916. This is commendable but would have been far more so had provision been made for the shop equipment necessary to keep the new rolling stock in good shape. After all is said it is a rather discouraging problem for the mechanical department to maintain the modern locomotive with machine tools designed and bought to care for locomotives half its size.

The railroads did a wonderful job in 1922. Let us hope they will do even better in 1923. They will have to, judging from the traffic that must be moved to keep industry supplied.

Providing Source Data on Foreign Questions

THAT the people of the United States are taking a steadily growing interest in foreign relations is evident from the publication of the quarterly review known as *Foreign Affairs*. In sharp contrast to the rapidly increasing list of digests of various kinds, this review contains a wealth of source material. Realizing as we do the aversion of the average American to careful reading we cannot but admire the courage of the Council on Foreign Relations, Inc., its publishers.

As a nation we probably have some distance still to go before we can muster any considerable number of readers for a review so fundamental as *Foreign Affairs* and dealing with such a subject. Nevertheless we have made progress in the last two decades for it is doubtful if any such body as the Council on Foreign Relations could have been gathered together before the beginning of this century to father an enterprise like this one.

As the means of transportation and communication improve, the borders of countries shrink and the relation of country to country nowadays must be compared to that between city and city a few generations ago. As a result the questions of foreign relations and foreign policy must displace to a large extent the domestic questions which our fathers and grandfathers argued and compromised. To this end periodicals like *Foreign Affairs* and organizations like the Council of Foreign Relations have a real duty to perform. We, as a nation, should welcome their efforts and give them our hearty support.

Getting Acquainted With Western Customers

THE MACHINE builder who fails to visit the Pacific Coast from time to time and really study the situation, is missing an opportunity. Let him call it a half vacation if he will and bring Mrs. M. B. along, let him play golf part of the time if he must, but let him study the shop conditions as they are and see how they affect the selling of his product.

The machine builder will discover that, with few exceptions, there are no large shops and very little manufacturing on any considerable scale. The average shop is small, tackles any kind of work from mining machinery to ship repairs and gets away with it. The machine operator who knows but one machine would probably starve to death in most shops, no matter how skilled he might be. Here the old-time machinist who will tackle anything that is do-able still holds sway.

Considering the number of men in a shop, the machine equipment is of greater variety than is usual in the East. Milling machines, gear cutters of different types, lathes, planers, boring mills, shapers and grinders are frequently found in the most unexpected places.

Builders of these machines would learn much in many cases by actually seeing them at work under these conditions. The needs of the user may be very different than where machines are used on one class or even one size of work exclusively. And the users of these machines appreciate showing the builder how well they handle his product.

Many builders whose machines are used quite largely on the Pacific Coast have never been farther west than Chicago or St. Louis. They owe it to themselves and to their trade to study conditions at first hand to get acquainted. It will pay to ask yourself if you can afford to neglect visiting a field which buys about five million dollars' worth of machine tools a year.

Shop Equipment News

American Gear Grinder Co. Spur Gear Grinding Machine

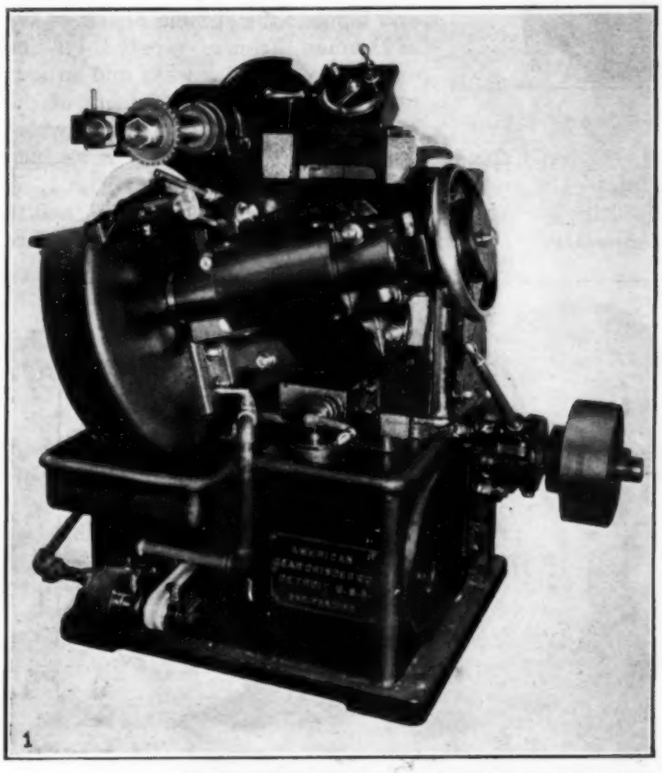
In view of the increasing demand for quiet, smooth-running and durable gears, particularly hardened steel gears for automobile transmissions, a machine for grinding the teeth of spur gears in order to obtain perfect tooth contour, accurate spacing and concentricity of the pitch circle with the bore has recently been developed by the American Gear Grinder Co., Benson St. and Bellevue Ave., Detroit, Mich. The incorporators of this company are Albert J. Ott and son, Conrad L. Ott, both formerly of the Ott Grinder Co., at Indianapolis.

The machine is so designed that the actions of the carriage and work-holding parts, in connection with the grinding wheel, generate a true involute curve, although the curve can be varied so that any desired tooth contour and dimension within reasonable limits can be obtained. The machine is adapted for grinding the teeth of spur gears with pressure angles up to 25 deg., of any diametrical pitch from 12 to 3, of any pitch diameter from 1½ to 8 in., and up to 1½ in. face.

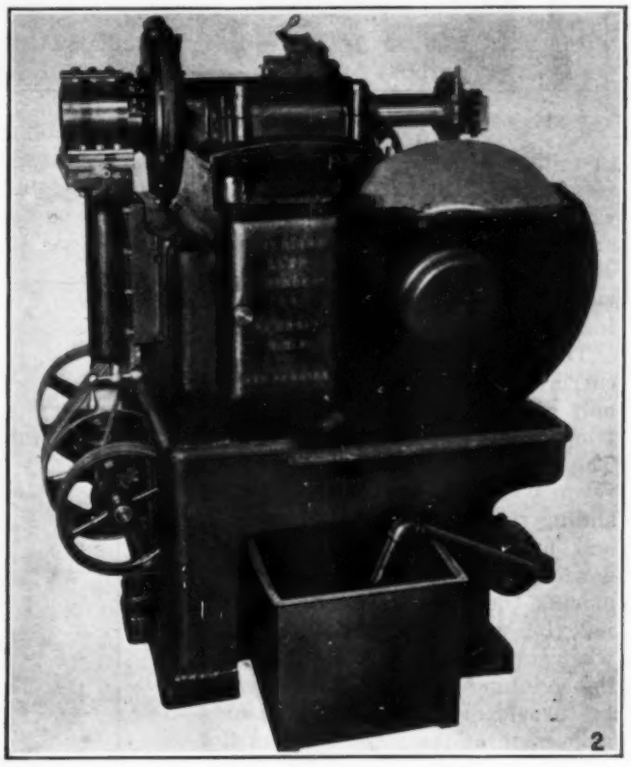
All control levers are within easy reach of the operator, as may be noted in Fig. 1. Heavy and high speed units are mounted low and the work arbor with the slow moving carriage is above the wheel at suitable loading height. The carriage is actuated by power, and the easily rotatable work spindle is oscillated by thin steel tapes mounted on the outer end of the spindle, where they are readily accessible. Other features are an automatic stop to the work carriage; the reversible wheelhead, which can be set either side of center to the proper grinding angle; the centrifugal water pump and removable tank.

The machine is self-contained and so designed that it can be driven by a belt direct from the lineshaft or countershaft, or from a motor which can be located in the base of the machine. Sturdiness is a feature of its construction, every part being designed with a view to the elimination of vibration and the production of theoretically and practically perfect gears.

The front view of the machine shows the relation of the grinding wheel to the work-carrying mechanism, the water guards being removed. The work arbor locates in a large taper hole in the work spindle mounted on the sliding carriage, which is actuated by a drum cam carried in the bed of the machine. At the other end of the work spindle, as shown in Fig. 2, is a cylinder of approximately the same diameter as the pitch diameter of the gear to be ground. To the cylinder are attached two pairs of thin steel tapes, which are wound around and anchored to the cylinder and are also



1



2

FIG. 1—AMERICAN SPUR GEAR GRINDING MACHINE. FIG. 2—SIDE VIEW OF MACHINE

anchored to a rigid bracket, so that as the work carriage slides back and forth, the work spindle is oscillated by the winding and unwinding of the tapes; this action is equivalent to rolling a perfect gear in a perfect rack. The rigid bracket to which the tapes are anchored can be adjusted for height to accommodate various sizes of gears, and adjustment is provided for the corresponding difference in tape length.

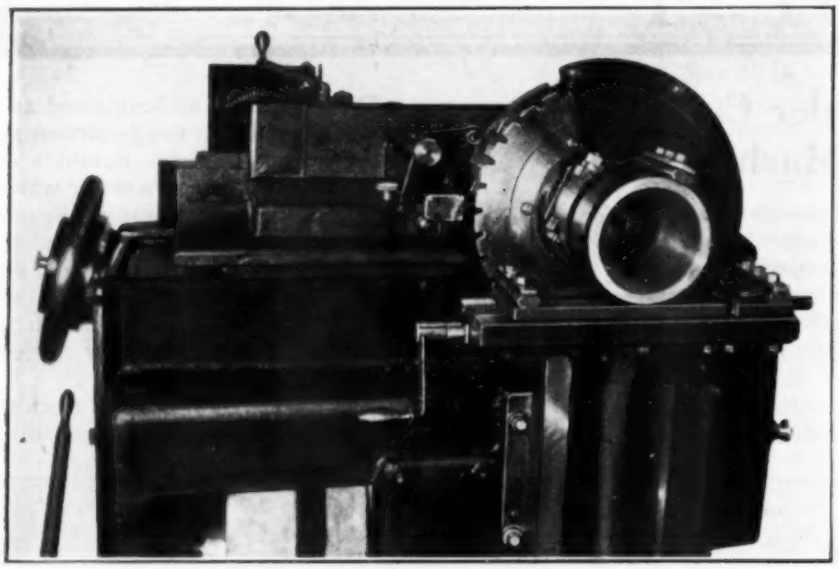


FIG. 3—INDEXING AND INVOLUTE CURVE PRODUCING MECHANISM

There are but four gears in the carriage cam drive; they are the only gears used in the machine and two of them are speed change gears. The drum cam provides a positive reversal of the carriage, eliminates sliding reverse clutches and springs, and provides a means of cutting down the grinding time per tooth by moving the carriage rapidly during indexing and at a moderate speed when the gear tooth is in mesh with the grinding wheel. Change gears are provided to grind one side of a gear tooth at the rate of either 4, 5 or 6 sec., and means are incorporated within the bed of the machine to change the length of travel and position of the carriage.

The carriage is controlled by the automatic stop mechanism which is located on the top of the wheel column, as shown in Fig. 1. This stop may be set to grind from one to sixty teeth and after the last tooth is ground it will stop the carriage with the gear free from the grinding wheel, and in proper loading position. A device for locating the gear in proper relation to the grinding wheel is provided.

The natural roll of the work spindle is used for indexing the slotted steel disk which controls the spacing of the gear being ground. After the gear has rolled out of the grinding wheel, that is, to the right in Fig. 1, a cam lifts the index finger out of the index plate slot, which can best be seen in Fig. 3. At the same time a secondary plunger moves into the same slot and holds the disk until the index finger has traveled on the periphery of the disk to the next slot, where it drops in and starts the disk in rotation again after the secondary plunger releases. The plate is ½ in. thick; the index plunger occupies three-fourths of this width, the secondary occupies the remainder. The entire mechanism runs in a bath of oil, although the illustrations show the oil pan and cover removed.

Less than one second is needed to index a tooth with this mechanism. It is claimed that during production grinding gears of 32 teeth, 6-8 pitch (stub-tooth gears of 6 pitch cut to 8 pitch depth) have indicated a total accumulated error of 0.0005 in. over eight teeth, and stem gears of 16 teeth, 6-8 pitch have indicated a total accumulated error of 0.0003 in. over four teeth.

The grinding wheel is mounted on an alloy steel spindle 3 in. in diameter that is hardened, ground and lapped; the spindle bearings are of Lumen bronze, tapered on the outside to allow for wear and adjustment. Horizontal adjustment of the wheel is controlled by a handwheel graduated in thousandths of an inch and shown at the right of Fig. 1. A positive stop for the wheel and a worm-driven wheel-truing device are provided. The wheelhead pad is equipped with an elevating mechanism and the wheelhead can be swiveled either side of center to any

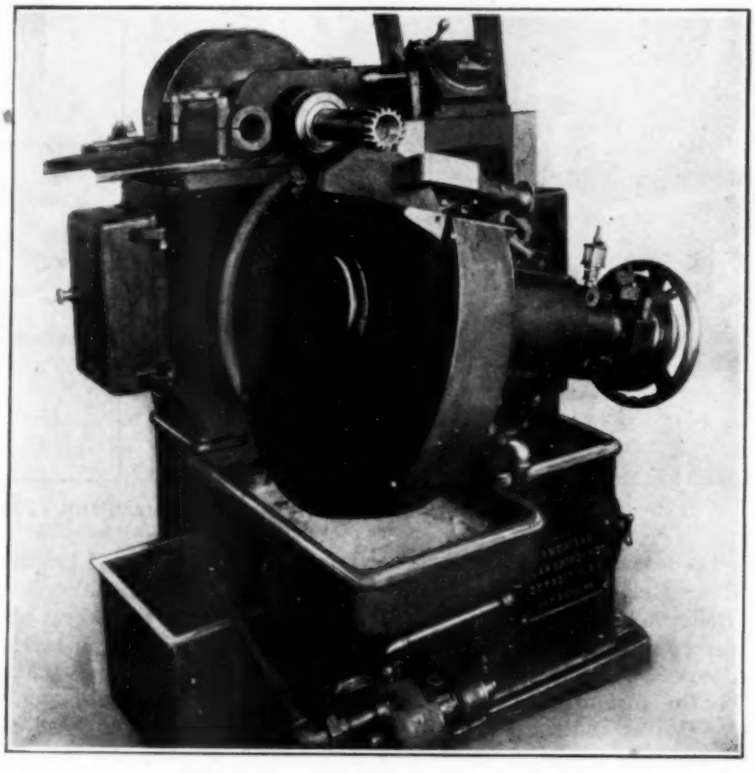


FIG. 4—WHEEL REVERSED AND SWIVELED TO 14½ DEG. ON RIGHT SIDE OF CENTER

angle up to 25 deg., giving a setting such as shown in Fig. 4.

The average spur gear can be reversed in order to grind both sides of the teeth, but in the case of a gear that is integral with the shaft, or any gear that cannot be reversed, the same result can be obtained by

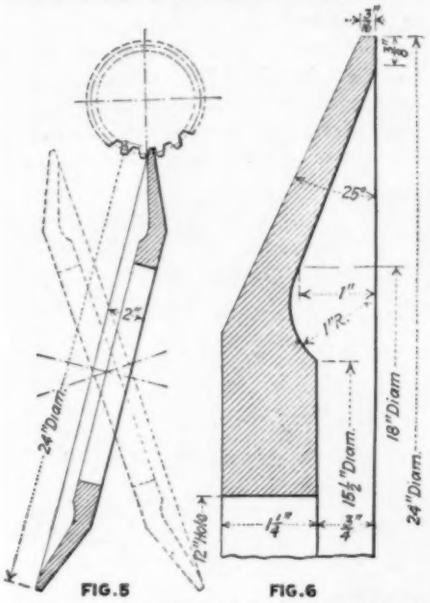


FIG. 5—REVERSIBILITY OF GRINDING WHEEL. FIG. 6—CROSS-SECTION OF WHEEL

swiveling the wheelhead in the opposite direction and reversing the grinding wheel. The method of doing this is shown diagramatically in Fig. 5. The same holding arbors can be utilized in this way.

One grinding cut is sufficient to produce a satisfactory finish in the case of the average gear, but in cases of bad distortion two cuts are necessary. When two cuts are taken, from 0.003 to 0.005 in. of stock are removed in the first cut and 0.001 in. in the second cut. The heaviest cut that has been tested on this machine was taken, it is stated, on a 32-tooth, 6-8 pitch, ¾ in. face case-hardened gear. This cut was 0.010 in. on all teeth, the grinding time was 3 min., there was no burning, and the wheel used was a Norton 6636 combination J. The shape and size of the wheel are indicated by the sketch in Fig. 6. It can be seen that there is over 1 in. of face wear obtainable, which should grind with careful truing over 1,000 gears of 32 teeth.

The use of this machine in the production of gears for automobile transmissions is stated to have effected a decided economy. Close working limits as to the form of tooth and the spacing in cutting the soft gear have been eliminated, thus doing away with the fine finish cuts. In many cases the total grinding time is said to be much less than that of the finish cutting operation. Also, inspection limits can be established and maintained so that gears can be interchangeably assembled with the assurance that as far as the gears are concerned the transmissions are quiet running.

Clark Lift-Truck Tote Box

For the purpose of increasing the usefulness of lift trucks and facilitating the movement of materials through the process of manufacture the Clark Tructractor Co., Buchanan, Mich., has recently devised and placed on the market a lift-truck tote box.

As shown in the accompanying illustration the box is made from

CLARK LIFT-TRUCK TOTE BOX

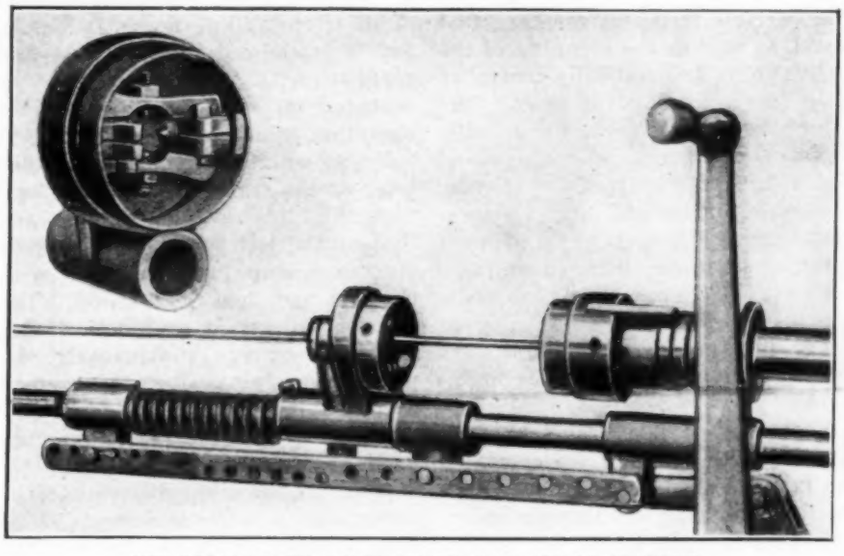
hard wood and is held together by standard section angle irons. The standard box has a capacity of 11 cu.ft. and is built to hold loads up to 4,000 lb. A floor space of 38x28 in. is occupied by it and it is 32½ in. in height. The inside dimensions of the box are 26¼x36¼x19¼ in. in width, length and height, respectively.

These tote boxes are designed to be carried either by power-driven or hand lift trucks. A clearance of 11½ in. above the floor is provided between the legs on the side of greatest length for the power trucks, and a clearance of 7½ in. on the narrower side for hand trucks. Two boxes can be carried at a time on a standard power lift truck.

Pearson-Scott Continuous Bar-Stock Feeder

The Pearson-Scott Co., 1525 East Washington St., Indianapolis, Ind., has placed on the market the continuous bar-stock feeder shown in the accompanying illustration. The device was designed for application to hand screw machines and is intend to eliminate the necessity for resetting the collar or pusher on the hand-feeding mechanism.

The gripping mechanism, which is shown at the top of the illustration, consists of a cast-iron housing enclosing a steel shell. In the shell are two bronze jaws, each carrying a tool-steel pawl. As the hand lever is pushed backward, the jaws release and slide on the bar; and as the lever is pulled forward, the jaws grip the stock and pull it along. The pawls are threaded and the heads are slotted so that they can be adjusted by means of a screwdriver. The stock is held central between the pawls by means of two screws that can be adjusted to provide the necessary clearance. The feeder can be furnished for any size of stock.



PEARSON-SCOTT CONTINUOUS BAR-STOCK FEEDER

Brown & Sharpe Automatic Manufacturing Milling Machine

A manufacturing type of machine for the automatic milling of duplicate parts in large quantities has recently been placed on the market by the Brown & Sharpe Manufacturing Co., Providence, R. I. The machine, a general view of which is shown in Fig. 1, is known as the No. 33 automatic milling machine.

The automatic control of the spindle and table by means of dogs located at the front and rear of the table is a feature of the machine. The variable feed and constant fast travel, as well as the stopping of the table, can be automatically controlled by properly setting the dogs. The dogs also provide for automatically actuating the starting, stopping and reversing controls for the spindle. The table and spindle may be operated entirely independently of each other, or they may work in conjunction with each other. The spindle can be set to run continuously in either direction, or to stop and start in conjunction with the table movements.

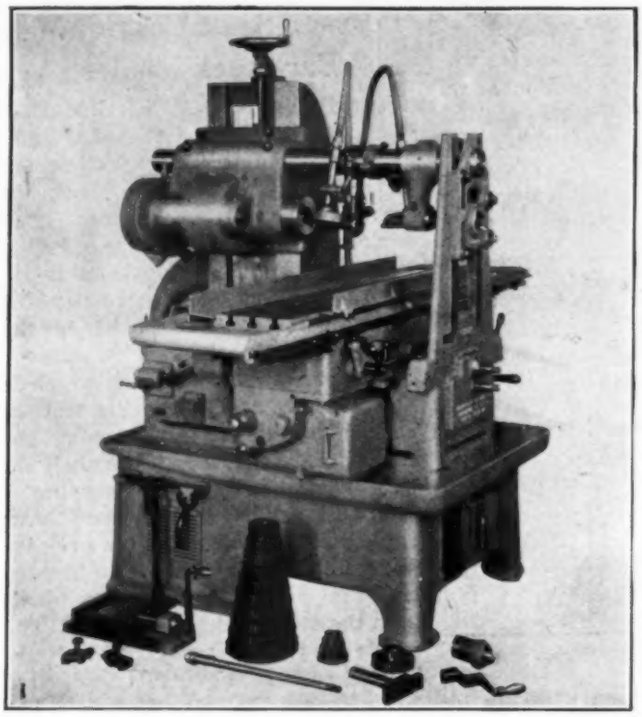
The constant fast travel in combination with the slow variable feed can be controlled automatically with the table running in either direction. It is said that the latter feature, together with the independent automatic control of the direction of spindle rotation, permits the automatic machining of many duplicate pieces on a production basis that would otherwise be handled by comparatively slow methods.

Although the automatic control of the spindle and table is by means of the table dogs, the same result may be obtained by hand by means of the two controlling levers conveniently located on the front of the saddle as shown in Fig. 2. The manipulation of these controlling levers is simple, and it is claimed that the ease and rapidity with which they may be operated in some cases gives faster operation than when the machine is fully automatically controlled. The lever at the right of the saddle controls the table reverse and stop, and that at the left controls the spindle start and stop in conjunction with the fast and slow table travel. The spindle will act in conjunction with the table or run continuously, depending on the position of a small lever on the left-hand side of the machine toward the rear. Another lever on the same side and slightly forward of the other disconnects the automatic spindle reverse These hand control levers also permit the operation of the machine as a plain milling machine, when so desired.

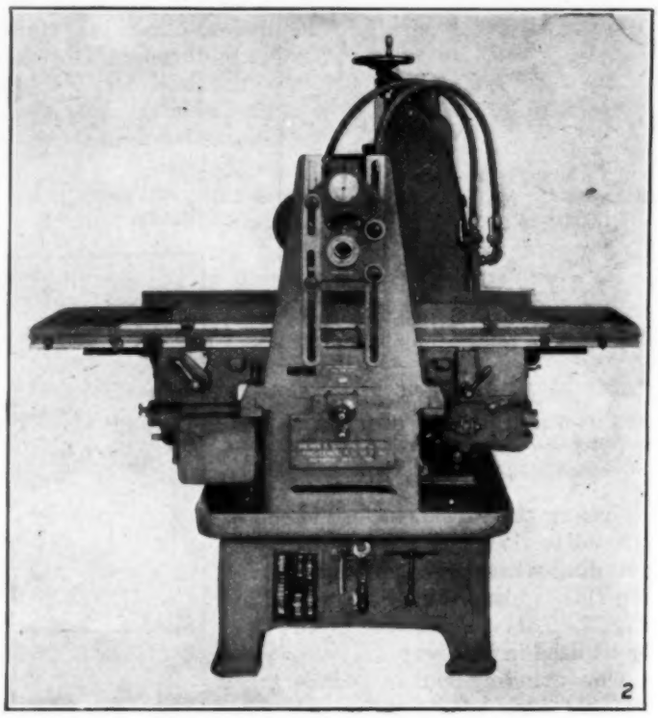
The spindle reverse is entirely independent of the table reverse. The constant fast travel and slow variable feed of the table may be made to function intermittently with the table moving in either direction, and the spindle may revolve either right- or left-hand.

The spindle may be stopped while the table is on its return travel. The arrangement is intended to eliminate the marring of the work by allowing the cutter to run back over the surface machined on the forward movement of the table. The provision for reversing the spindle permits the use of two sets of cutters with teeth facing in opposite directions, so that a cut can be taken on both the forward and return movements.

On a shaft, shown in Fig. 4, parallel to the main drive shaft and driven from it by spur gears are the friction clutches for the starting, stopping and reversing of the spindle automatically. Power is transmitted from the shaft by spur gears to another at the base of the column on which is mounted a silent chain sprocket. The spindle drive through the silent chain is so arranged that a system of idlers keeps the tension constant regardless of the height of the spindle. The sprocket in the top of the column may be raised or lowered from the outside of the machine and permits, it is claimed, any neces-

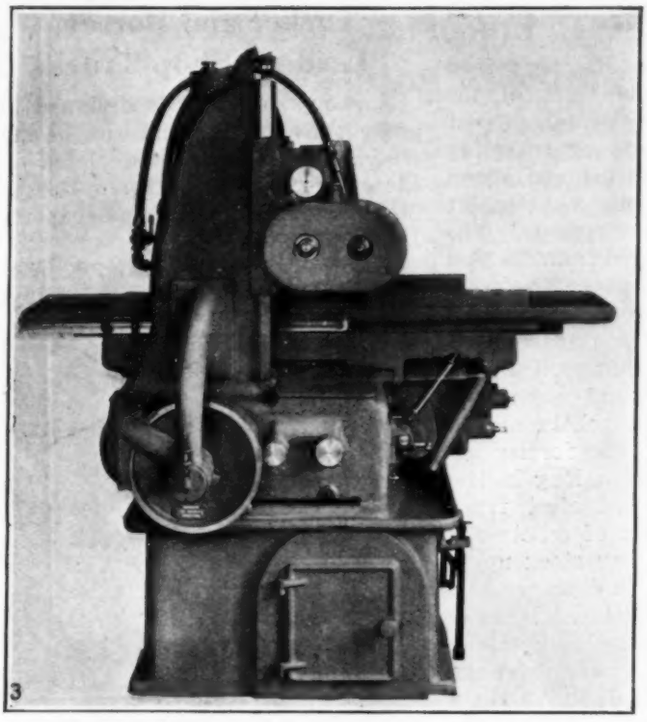


1



2

FIG. 1—B. & S. AUTOMATIC MANUFACTURING TYPE OF MILLING MACHINE. FIG. 2—FRONT VIEW OF THE No. 33 MILLING MACHINE



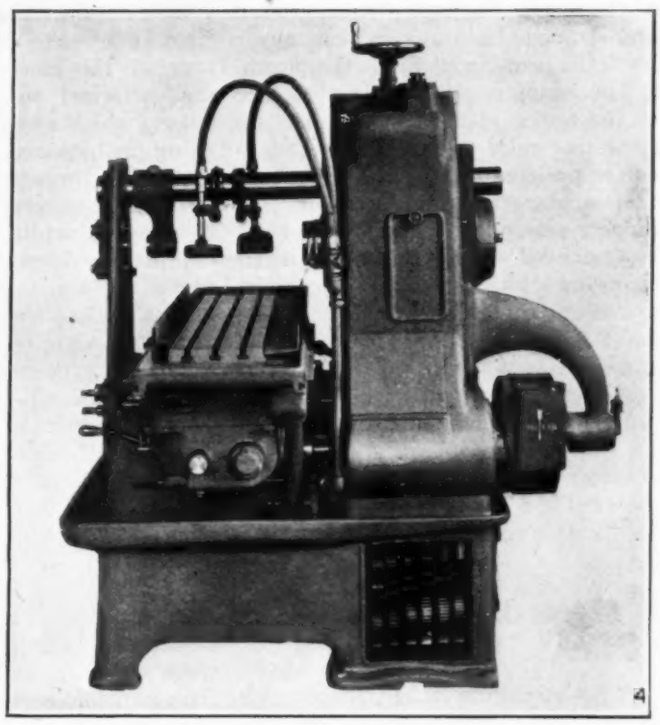


FIG. 3—REAR VIEW OF THE B. & S. AUTOMATIC MILLING MACHINE. FIG. 4—RIGHT-HAND END OF THE MACHINE

sary adjustments to be easily and quickly made, as when taking up wear.

The machine is driven from a single pulley which runs at a constant speed of 350 r.p.m., and is attached at the rear of the machine as shown in Fig. 3. The controls are entirely within the machine. A feature of the constant-speed type of drive is the complete separation of the spindle speeds and table feeds, permitting any combination of the two within the capacity of the machine. Variations of the spindle speeds are obtained through change gears giving twelve changes of speeds in geometrical progression from 22 to 180 r.p.m. in either direction. The table feeds are positive and are entirely independent of the spindle speeds. There are eighteen changes ranging in practically geometric progression from 0.38 to 24.54 in. per min., which provide a range per revolution of the spindle of 0.002 to 0.136 in. for small mills and 0.017 to 1.115 in. for large mills.

Provision is made for enclosing a constant speed motor within the base for a motor drive. The arrangement does not increase the floor space occupied by the machine and the motor is well protected from chips and dirt. The drive is by belt equipped with an automatic tightener and the whole mechanism is completely enclosed in a cast-iron guard.

Another feature of the machine is the automatic lubrication of all operating parts within the frame. The oil-tight cases contain reservoirs into which the rotating members dip, thus supplying lubricant to themselves and at the same time carrying the oil up to tubes running to the bearings. Rolls that dip into oil reservoirs keep a film of oil constantly on the table ways. The cutting lubricant is pumped to the work from a large tank cast in the base. Two nozzles are provided for supplying lubricant to the cutters, either or both of which may be cut off if not wanted.

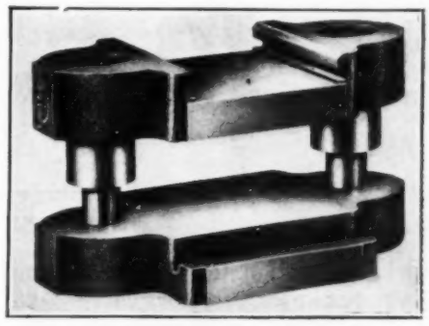
The machine has an automatic longitudinal feed of 34 in. and a transverse adjustment of 5¼ in. The spindle can be adjusted vertically through a distance of 15 in. The spindle nose has a No. 11 B. & S. taper, and the hole through the center which accommodates the drawing-in rod is ⅛ in. in diameter. The diameter of the driving pulley is 14 in. and it carries a 4½ in. belt.

The diameter of the hole in the bronze bushing of the arbor support is 2⅞ in. The distance from the center of the spindle to the underside of the overarm is 5½ in. The greatest distance from the end of the spindle to the center of the arbor yoke, without arm braces, is 27 in. The maximum distance from the end of the spindle to the bushing in the arm braces is 19¾ in. and from the spindle head to the arm braces, 24 inches.

The over-all dimensions of the table are 74 x 17¼ in. and its working surface is 52 x 12½ in. Three ⅝-in. T-slots are provided on the table. The complete machine weighs approximately 6,200 lbs. and occupies a floor space of 108 x 69 inches.

Danly Type-Z Die-Set for Punch Press

The latest addition to the line of products of the Danly Machine Specialties Co., 1613 N. Lincoln St., Chicago, Ill., is the Type-Z die-set shown in the illustration herewith. The device is intended especially for punch presses used by adding machine and typewriter companies and



DANLY TYPE-Z DIE-SET FOR PUNCH PRESS

other manufacturers requiring stampings of accuracy.

The die-set has a "floating" punch shank that is claimed to relieve strains due to the play in the ram

of the press. Long, hardened, ground and lapped bushings which never leave the leader pins guide the punch.

The adapters which take the place of the punch shank can be made up for either solid swivel, spring knock-out or positive knock-out. A feature of the adapters, which provides for quicker set-ups, is that they need not be removed from the ram when changing dies. It is only necessary to remove the clamps from the shoe and slide the die-set from the adapters.

A complete range of sizes is obtainable to accommodate dies from 4 x 4 in. to 10⅜ x 10⅜ in. All are made of carefully machined semi-steel and possess the advantage of interchangeability of punch holders.

Myers 10-Inch Engine Lathe

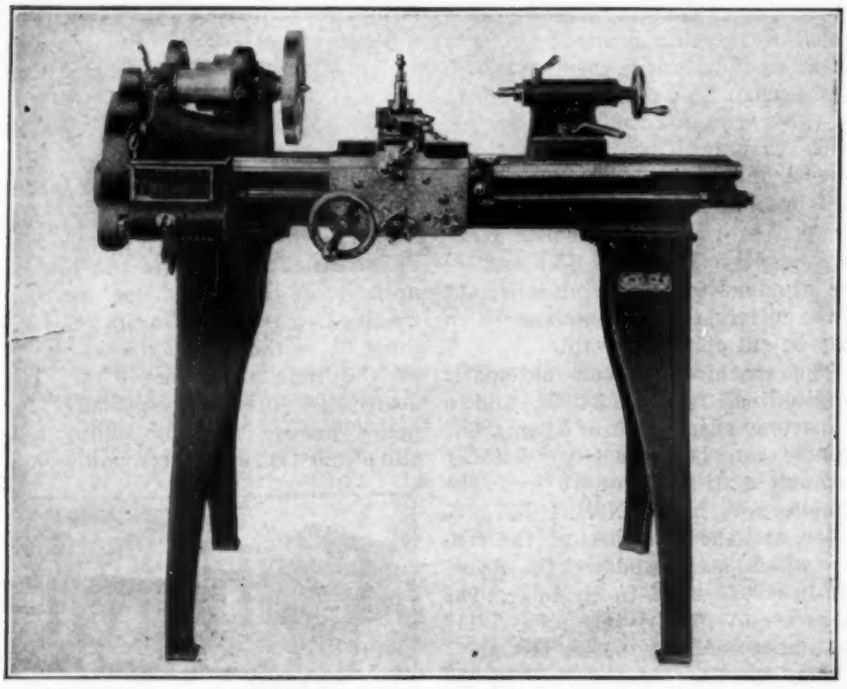
A 10-in. engine lathe with a quick change gear box mounted on the front, as shown in the illustration herewith, has recently been placed on the market by the Myers Machine Tool Corporation, Columbia, Pa. The gear box provides for cutting 25 threads from 6 to 52 per inch. The threads on the lead screw are employed only when thread cutting.

A three-step cone pulley is employed. The back gears have a ratio of 7 to 1 and are protected by a swinging-gate type of guard. A countershaft with forward and reverse friction pulleys running at 200 r.p.m. drives the cone pulley. A feature of the machine is the thread dial attached to the right of the apron, which avoids the necessity of using a backing belt or reversing motor for thread cutting and allows the extra pulley on the countershaft to give six additional speeds. The dial may be disengaged from the lead screw when not in use. The cross feed also is power operated, and a compound slide rest is provided.

The machine can be supplied with a number of attachments such as a draw-in chuck with collets and a taper attachment. The former attachment consists of a long hollow steel bar, a hardened steel taper bush, and a number of collets for holding any length bar stock up to a maximum of ⅜ in. in diameter.

The lathe has a distance between centers of 24 in., a swing over the ways of 10½ in. and a swing over the the compound rest of 6½ in. A No. 2 Morse taper is provided for the spindle and the tailstock. The spindle is of high-carbon steel and runs in phosphor-bronze bearings. It has a 1⅛-in. hole through it, so that it can carry a ¾-in. rod.

The machine can be furnished for use on either the floor or a bench. The floor type weighs 400 lb. net, and when crated its dimensions are 53x50x30 in., respectively, in length, height and width. The bench type weighs 360 lb. and occupies a space of 53x22x28 in. when crated.



MYERS 10-INCH ENGINE LATHE

Tucker and Dorsey "Leader" Shop Trucks

A shop truck that is designed to prevent the buckling under of the end wheels has recently been placed on the market by the Tucker & Dorsey Manufacturing Co., Indianapolis, Ind.

The truck, shown in Fig. 1, is of the usual hardwood construction with cast-iron wheels and metal fittings. The feature of the truck lies in the end construction shown in Fig. 2. As can be seen, the swivel wheel is held between the end sill and the center platform girder by a heavy stamped-steel form. The form is bolted to the girder, carried around the swivel between the housing and top plate, then passes under and up the side of the end sill and under the two lower bolts used in securing the swivel top or plate to the end sills. Since the platform girder rests against the two cast-iron lugs on the swivel, a rigid construction is obtained.

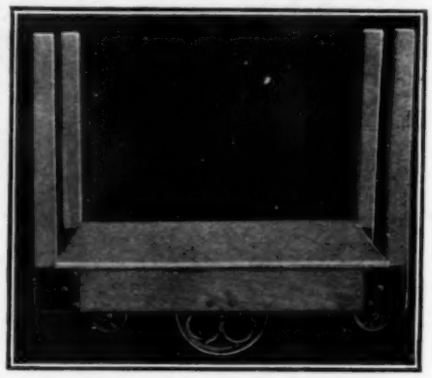


FIG. 1—T & D "LEADER" SHOP TRUCK

The platform is of ⅞-in. hardwood and is triple nailed to a hardwood frame of 1⅜x6-in. section. The sections are firmly bolted together with heavy stamped-steel corner sockets into which hardwood removable stakes are inserted as here shown.

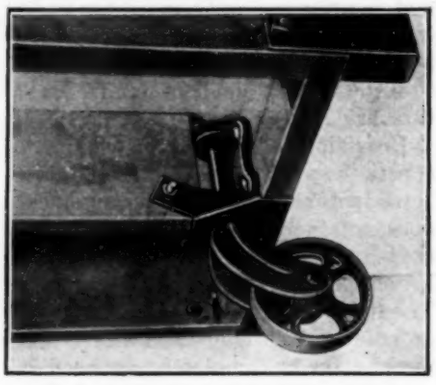


FIG. 2—SWIVEL WHEEL AND END CONSTRUCTION

"Autosan" Improved Metal-Parts Washing Machine

The "Autosan" metal-parts washing machine made by the Colt's Patent Fire Arms Manufacturing Co., Hartford, Conn. and previously illustrated on page 496, Vol. 56 of the *American Machinist* has been enlarged, improved and adapted to the cleaning of many of the parts produced by the automobile manufacturer. It is now made upon the unit principle with a frame work of light structural steel and can be furnished in practically any desired length by the joining of units. Fig. 1 shows a general view of a large machine from the spray side.

The pumping units are self-contained, each being provided with a centrifugal pump, driving motor and independent control, all mounted upon a cast-iron base. The rotor shafts run upon ball bearings. The rotor shaft nearest the operating end has a worm which drives the conveyor through a wormgear, sprockets and chain.

The control lever is located conveniently to the operator and is arranged to stop the movement of the conveyor without stopping the sprays. An automatic safety stop is provided so that should a piece of work catch in the conveyor, the machine will stop and remain inoperative until the piece is dislodged. The conveyor is made up of separate links ¼ in. thick. It is supported throughout the length of the machine by a series of idle rollers, that sustain the weight of the work being cleaned.

The spray chambers are mounted from the outside of the hood, so that they may be cleaned at any time without dismantling the machine, by merely removing the plugs at either end. The machine is provided with tanks of ample capacity for holding the soda solution and rinsing water, and each tank has a steam coil for heating the contents. When heated to the required temperature, the main valve is closed and sufficient steam admitted through a needle bypass to maintain the proper degree of heat.

The machine is regularly manufactured in ten sizes and may be increased in length by the addition of the required units. In Fig. 2 is shown a view looking through the machine along the conveyor. Hinged doors, not shown, close the ends of the hood, and are opened and closed by the passage of the work without attention from the operator. Conveyors can be arranged at each end for handling the work to and from the machine when the conditions warrant.

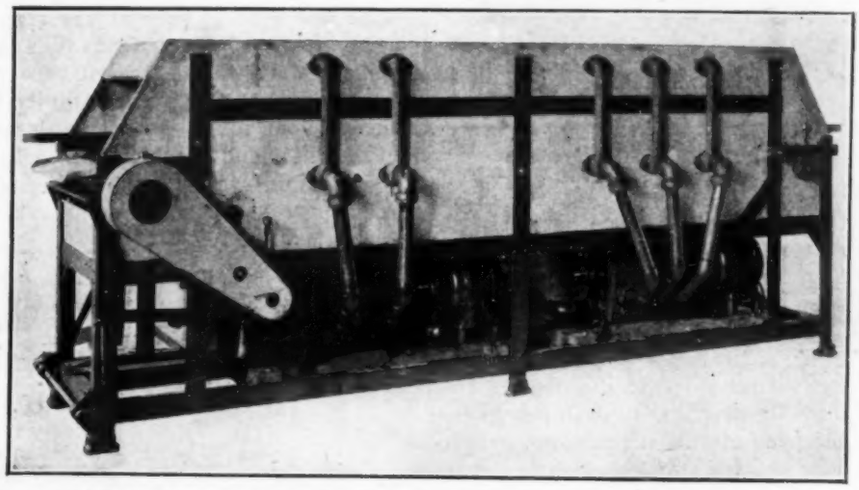


FIG. 1—COLT "AUTOSAN" METAL-PARTS WASHING MACHINE

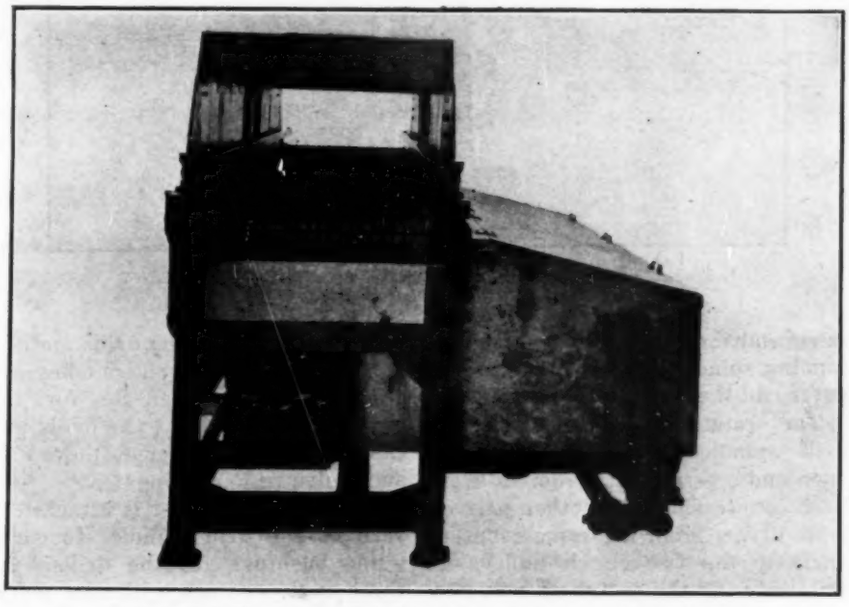


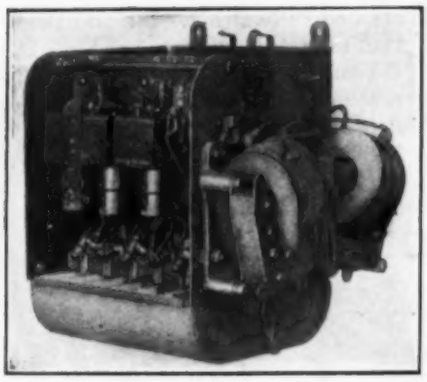
FIG. 2—END VIEW OF "AUTOSAN," SHOWING CONVEYOR

Westinghouse Automatic Auto-Starter

A decrease in size and an increase in reliability are claimed to be the features of an automatic auto-starter recently placed on the market by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., for use in starting squirrel-cage induction motors such as commonly used for machine drives. The entire mechanism of the starter is inclosed within a sheet-steel case provided with covers, which are removed in the accompanying illustration. The tank enclosing the contacts can be dropped to permit of inspection.

The auto-transformer is built of silicon-steel laminations with insulated coils, which are provided with taps for adjusting the starting voltage and, consequently, the starting torque. The contacts are of the rolling type. They are actuated by a dual magnetic mechanism which automatically closes the starting contacts first, holds them for a predetermined time, depending on the setting of the accelerating relay, and then automatically opens the starting contacts and at once closes the running contacts.

Interlock fingers are connected to



WESTINGHOUSE AUTOMATIC AUTO-STARTER

the rotating shaft so that when the starter is in the running position the fingers make a circuit which maintains itself through the run magnet. The run magnet, therefore, also functions as a low voltage relay. The control relay is given a definite time limit by means of a dash-pot so that the time of starting a motor may be adjusted for any period up to a maximum of 15 seconds.

The starter is operated either by a master switch or by push buttons for remote control. Full automatic operation may be obtained by the use of a float switch or a pressure gage relay.

Overload protection on all phases is provided by a two-coil, overload relay connected in two of the phases. An inverse-time-limit arrangement prevents the overload relay from opening the circuit on instantaneous peak loads. A latch is fitted to the relay which prevents starting the motor after overload until the relay has been reset electro-magnetically by a reset push button.

Langelier Drilling and Tapping Machines for Terminal Boxes

The Langelier Manufacturing Co., Arlington-Cranston, R. I., has recently developed two machines for drilling and tapping the terminal boxes used on electric wiring.

The machine shown in Fig. 1 drills four holes simultaneously and taps them in a succeeding movement without removing the work from the machine. The terminals are held in a sliding fixture, built especially to accommodate the particular part for which the machine is set up. Two opposed spindles at the front of the machine each carrying a Langelier multiple drilling unit having two auxiliary spindles mounted at close center distance and driven by means of an eccentric bushing in the end of the main spindle. The two tapping spindles at the rear of the machine are similiarly equipped.

The two drilling spindles have an endwise movement actuated by a double rack and pinion operated by means of the inner one of the pair of hand levers to be seen at the right, a movement of which feeds all four drills toward the central fixture at the same time. The feeding pinion is keyed to the inner end of the sleeve, to the outer end of which is attached the feeding lever. Passing through this sleeve is a shaft having at the inner end the pinion for feeding the tapping spindles forward, and at the outer end the operating lever.

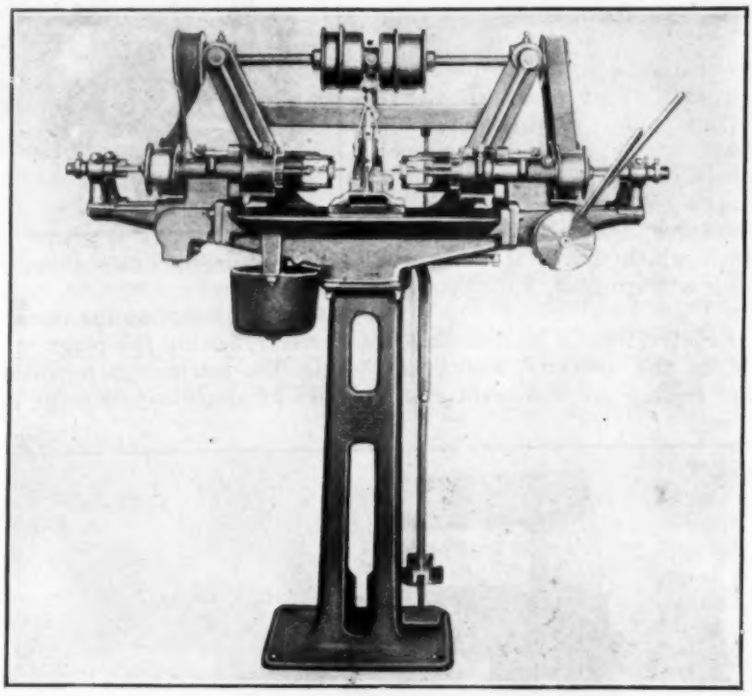


FIG. 1—LANGELIER HORIZONTAL MACHINE FOR DRILLING AND TAPPING FOUR HOLES

The rotative movement of the drill spindles is derived through open and crossed belts from an overhead countershaft. Another pair of belts drives from the same countershaft to the two clutch pulleys at the center of the jackshaft mounted on brackets at the rear of the machine. This shaft drives the tapping spindles in opposite directions by means of the short belts to be seen in the illustration. The reversing clutch is connected with the treadle so that when the latter is depressed and held in position by a catch, the tapping spindles are driven in a right-hand direction until the advancing spindles reach and operate a knockout, which releases the treadle and causes the spindle to reverse and withdraw the taps automatically.

The yokes through which the feeding movement of the hand lever is communicated to the spindles are suspended between two opposed springs so that the actual rate of advance and recession is governed only by the lead and speed of rotation of the taps, and is therefore independent of the operator.

The driving pulleys for all spindles are mounted upon independent ball bearings, so that the spindles are relived of belt strain. Adjustable stops are provided to limit the forward movement of the drills and the feeding yokes upon all spindles are adjustable to compensate for the gradual shortening of the drills and taps as they are ground away in successive resharpenings.

A sliding steadyrest is attached to each of the drill spindles to carry guide bushings for the drills. As these rests contact with the work-holding fixture they remain stationary, while a spring allows the advance of the spindles to continue.

The work-holding fixture clamps the piece by a single movement of a cam lever and, as the drilling is completed, the fixture slides to the rear of the machine, bringing the drilled holes into alignment with the taps. The normal rotative speed of the drill spindles is 2,100 r.p.m. and of the tapping spindles 565 r.p.m.,

variable by means of cone pulleys upon the countershaft if desired. The machine occupies a floor space of 5 x 2½ ft. and is approximately 5 ft. high. The net weight is 1,100 pounds.

The machine shown in Fig. 2 is designed for the same class of work where there is but a single hole to be drilled and tapped. The mechanism is of a similar nature to the machine previously described, except that the reversal of the tap is accomplished by a Jarvis tapping chuck.

The drive is by a single belt from an overhead shaft to tight and loose pulleys upon the horizontal shaft at the rear of the machine. This shaft drives through helical gearing two upright shafts, each terminating in a driving pulley at the upper end, from which short belts drive directly to the spindles. The helical gears are enclosed and run in oil. Guards are provided partially to enclose the belts.

The feed for both spindles is actuated by a single hand lever to the right of the column. The work holding fixture slides sidewise under the spindles, and, as in the other machine, the work is clamped by the movement of the lever. A bushing in a sliding steadyrest guides the drill. The fixture must be designed to accommodate the particular piece of work for which the machine is set.

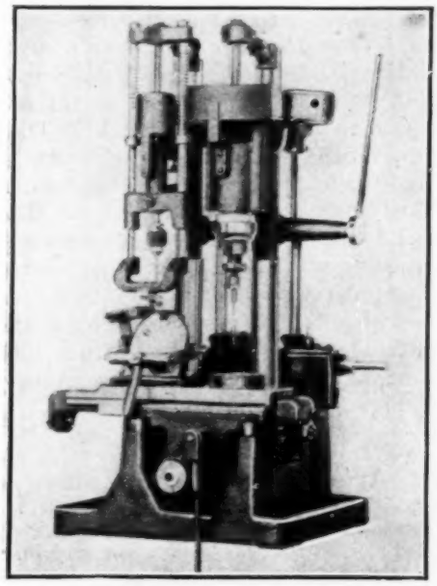
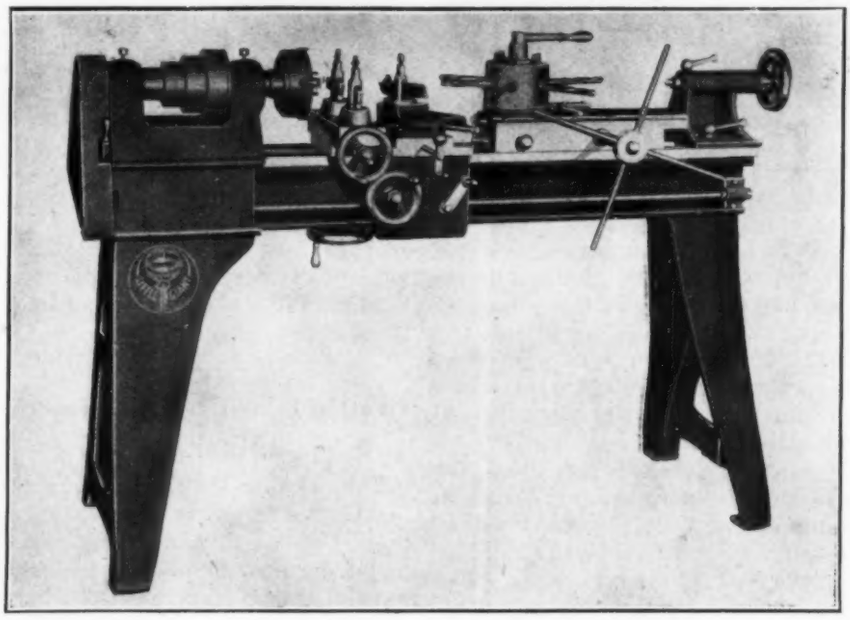


FIG. 2—MACHINE FOR DRILLING AND TAPPING SINGLE HOLES

This machine is intended to stand on a bench. It occupies a bench space of 1 ft. 6 in. x 1 ft. 3 in., and weighs approximately 250 pounds.

"Little Giant" Combination Metal and Wood Lathe

By the use of both metal and wood working attachments many metal and wood working operations may be performed on a recently marketed lathe, shown in the illustration herewith, manufactured by the Little Giant Co., Mankato, Minn. The standard bed is 48 in. in length, 7 in. in width, 6¾ in. in depth and stands 36 in. above the floor. The greatest distance between centers is 25 in. Beds of greater size can be furnished, however.



"LITTLE GIANT" COMBINATION METAL AND WOOD LATHE

The headstock of the machine has a length of 13½ in. and a width of 10¾ in. at the base. Its overall height is 9 in. Tapered bronze bearings are provided that can be adjusted to keep the headstock spindle in alignment with the tailstock spindle. The alloy-steel headstock spindle is 17 in. long, 1½ in. in diameter and has a ¾ in. hole through the center. It is threaded at both ends so that faceplates and chucks may be attached to it. Eight spindle speeds are possible, ranging from 30 to 360 r.p.m. The spindle is driven by means of a 4-step cone pulley. A No. 3 Morse taper hole is employed.

The tailstock, which has a base 7x7 in. and height of 8 in., is clamped to the bed by means of a hand lever. It is furnished with a setover device for taper work. The alloy-steel tailstock spindle is 7⅜ in. long, 1¼ in. in diameter and has a travel of 4 inches.

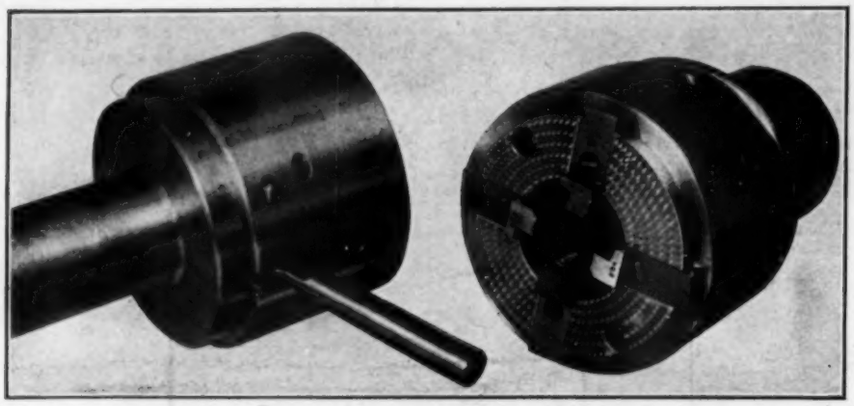
Both hand and automatic feed carriages can be provided. The former has a cross feed and swivel rest. The latter is driven by the lead screw, from the rear end of the headstock spindle. All combinations ranging from 1-48 to ½ in. are available. The hand and compound swivel tool rests are interchangeable. The compound swivel rest is used for general work. The toolpost slide has a circular base graduated through the full circle.

Special features of the machine which make it adaptable for many metal working operations are the turret, milling, motor wheel, gear cutting, thread cutting, and grinding attachments. The automatic turret head has six post holes to receive tools and is claimed to practically convert the lathe into a screw machine. The milling attachment can be installed at the rear end of the lathe, and handles any class of milling work within its range. For cutting gears, keyways and splines the gear cutting attachment can be used, and threads from 1-48 to ½ in. may be cut on the thread cutter. The grinding attachment may be used for grinding, buffing and sharpening work. Other attachments include a band saw, saw table, jointer, planer, morticer, sander and buffer for wood working operations.

The floor space occupied by the lathe when on floor legs is 24x50 in. and it stands 46 in. high. On a bench the lathe occupies a bench space of 11x50 in. and is 19 in. high. When used as a wood lathe a ½-hp. motor for light work and ¾-hp. motor for heavy work running at 1,800 r.p.m. is recommended.

"Namco" Hardened Self-Opening Die-Heads

The National Acme Co., Cleveland, Ohio, has recently brought out a line of hardened self-opening die-heads made in both the non-revolving type, as shown at the left in the illustration, and the revolving type shown at the right.



"NAMCO" HARDENED SELF-OPENING DIE-HEADS

The non-revolving type is used on hand screw machines, turret lathes and other machines where the threading tool is not revolved. Seven sizes are available, with capacities for straight threads ranging from a minimum of $\frac{3}{16}$ in. to a maximum of 3 inches.

The revolving type opens and closes automatically while running. This type is used on automatic screw machines and other similar machines where the work is stationary while the die revolves, or where both the work and die revolve. Five sizes are available with a capacity for straight threads from a minimum of $\frac{3}{16}$ in. to a maximum of $2\frac{1}{2}$ inches.

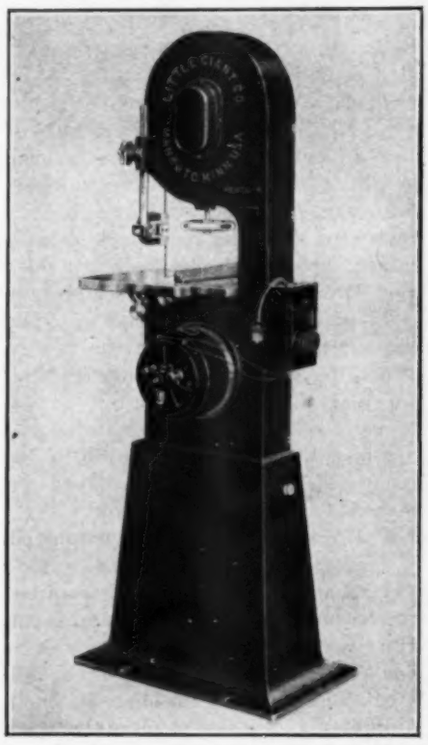
The body and shank are made in one piece, as are also the cam and cup, so as to obtain a simple construction. A number of small parts are eliminated because the bearing of the chasers is directly against the solid cup-cam. There is no face cup to hold chips and dirt. With the exception of the chasers there are in all only ten parts used in the construction of the die-heads.

All the working parts are hardened, ground and made of alloy steel. The chasers are hobbed and lapped, and are ground at the bottom. They fit hardened and ground plates, and are supported to provide rigidity while cutting. The chasers are fitted so as to project beyond the body of the die-head and thus permit threading close to shoulders and to provide freedom from chips. Each set of chasers is given a running test.

The shank for the die is made either soft or hard, as desired, a hardened plate for the screw being supplied when a soft shank is used. An inside trip can also be furnished. A screw in the side of the head provides for varying the diameter. Changing from right- to left-hand threads can be easily done.

"Little Giant" Band Sawing Machine

The Little Giant Co., Mankato, Minn., has recently placed on the market a line of band saws, belt or motor driven, and made in four sizes having wheels from 12 to 48 in. in diameter. The accompanying illustration shows the model A machine, which has a wheel 12 in. in diameter. The main frame is a heavily ribbed one-piece casting. All working parts are full enclosed. The upper wheel is spring mounted and adjustable to suit the blade length.



"LITTLE GIANT" BAND SAWING MACHINE

The table can be tilted 45 deg. outward by means of a graduated adjustment and has an adjustable graduated fence for ripping. Disk roller guides are provided above and below the table to guide the saw blades. A sliding drawer at the rear of the base of the machine catches the saw dust. The machine is equipped with S.K.F. self-aligning ball bearings throughout.

Motor and belt driven machines can be changed from one type to another, and either type removed from its base for bench mounting. The motor driven equipment has a safety plug box attachment to prevent damage to the motor by overloading.

A motor of $\frac{1}{4}$-hp., 1,200 r.p.m. drives the model A machine illustrated. The machine occupies a floor space of 15 x 20 in., has an overall height of 60 in. and weighs 300 lbs. The 12 x 12 in. table is 38 in. from the floor. An auxiliary table 4 x 9 in. is also provided. The main saw frame is 38 in. high, $13\frac{1}{2}$ in. deep, and $4\frac{1}{2}$ in. wide and has a throat space 10 in. deep and 6 in. high. The upper band wheel adjustment is 2 in., and the length of the saw bearing on the guide disk is $1\frac{1}{4}$ in. With the band wheels traveling at 1,200 r.p.m. a saw speed of 3,800 ft. per minute is produced.

The machine may be used as an attachment for, and driven from, the company's wood lathes and combination wood and metal lathes.

Argentina and the Motor Car Industry

Prior to the war, Argentina had imported upward of 17,000 automobiles, the annual imports having increased progressively over a period of 15 years, states a trade information bulletin of the Department of Commerce. These automobiles were largely European passenger cars with small motors for use chiefly in the cities of Buenos Aires and Rosario. By 1913, which was the record year in motor-car sales, the total importation was 5,115 cars, of which American cars made up 20 per cent. These were mostly low-priced light cars and were destined for use in the country districts. It was the American light car that was the pioneer in the Argentine country districts, but at the beginning of the war in 1914 American motor-car popularity was still limited to the sphere of the low-priced car for rough country use.

News Section

Support of Industrial Leaders Sought for Church Motion Pictures

Two well known manufacturers have just taken hold of the Church Motion Picture Corp., which utilizes the screen for the purpose of moral and religious education. It is a merger company which has gathered up the films and experience of the principal pioneer companies in its field. It is now proposed to create a foundation organization which will have a channel for contributions, but will also be a commercial business capitalized at three million dollars of preferred stock paying eight per cent, which will be offered to the public, and particularly to the men engaged in industry whose support is invoked and imperatively needed not merely from a patriotic and educational point of view, but for the preservation of industry in general.

William H. Barr, president of the National Founders Association, is president and John E. Edgerton, president of the National Association of Manufacturers, is chairman of the board.

In a recent letter to the National Founders Association, Mr. Barr says, referring to himself and Mr. Edgerton, "We shall devote our energy to make this Foundation a success, and we have undertaken the plan only after the most thorough study of the proposal itself, and of the situation which it is intended to help correct. Time and again in this letter we have discussed the necessity of economic education, and of the desirability of impressing upon the people the essential facts of sound government. The world has a perfect object lesson of what happens when a country or a people violate economic laws and seek to set up governments that are based on the greed of some, the theories of others, and the speculative philosophies of men who are utterly impractical.

What Is Asked

"The proposal is that the industrial leadership of the United States shall furnish a part of the initial capital funds of this Foundation. There is need for moral, patriotic, and economic education in America."

The letter then goes on to describe the facilities of the corporation and the demand for its films.

In conclusion Mr. Barr says, "These facts with regard to the Church Motion Picture Corp. of course will be merely the basis upon which will be started 'The Foundation' and to which will be brought the genius of the motion picture field, the knowledge of economics of men who are high in industry and finance, the moral and ethical power of the great teachers and preachers and the patriotic effort of men who have studied the political and social conditions which today are tending dangerously towards a change in our institutions. The new organization will reach into every corner of the country and will set up a means of education which will have illimitable benefits for every citizen.

"These things cannot be done without that co-operation which is based on intense interest and intense loyalty to our country without regard to class. But the industrialists of the United States are more gravely concerned with the success of this movement than any other body, and it is to them that this first appeal is issued, and it is from them that great support is expected."

Indianapolis Business Shows Gain

The volume of business done by the machinery houses in Indianapolis seems to increase steadily, according to C. A. Rassmann, vice president of the Vonnegut Machinery Co. However, during the last week or two there has been somewhat of a lull, which was to be expected following a three months' period of unusual activity. Most of the activity in the machinery trade comes from the automotive industry and the allied industrials. The demand for machine tools from the accessories manufacturers is forming quite a large portion of the total volume.

One of the largest industrial enterprises that will be established in Indiana this year is the Sullivan Machine Co., that is making preparations to move its plant from Chicago to Michigan City, Ind. The erection of the buildings that are to house the plant has been under way in Michigan City for nearly a year, and it will, probably, require another year to complete all of the structures that are on the company's building program.

It is the plan of the company to start its factory operations by June 1 in buildings that will be ready by that time, and from then on to expand its operations as buildings are finished.

Probably the most important thing in the city at the present time, insofar as it concerns the industry, is the attempt being made to lower fire insurance rates. Not only is the trade interested, but it is taking an active part in the movement. A reduction of rates by placing the city in a higher classification will mean the saving of thousands of dollars annually.

Standardizing Symbols

Sponsorship for the standardization of engineering and scientific abbreviations and symbols has been assigned to the American Association for the Advancement of Science, the National Research Council, the Society for the Promotion of Engineering Education, and the U. S. Bureau of Standards, jointly by the American Engineering Standards Committee.

Southern Metal Trades Thriving

Pig iron production in the Alabama district now has reached almost an average of 250,000 tons per month, which is the biggest production noted since the peak period of 1920, according to figures of the Southern Metal Trades Association, of Atlanta, Ga. The first quarter of the present year will total approximately 700,000 tons, and as production is steadily increasing from month to month the remaining three quarters should bring the total to at least 3,000,000 tons, considerably more than double that of 1921, and from 30 to 35 per cent greater than production in 1922. It was toward the latter part of 1922 that the industry in the South began its gradual recovery from the long period of business depression.

While Alabama is the greatest iron producing state in the South, there are a number of furnaces also in Tennessee and North Carolina, and the association reports that production is more active in these states than it has been in the past three years.

Practically all lines of industry in the South now are operating again on a healthy basis, with the outlook promising that 1923 will be one of the best industrial years of the past decade. In the metal trades industries, factories are, for the most part, going at capacity, and there has been more foundry and machine shop construction in this district the past three months than for some years.

Building is unusually active over the entire South, and bids fair to remain so, with many of the larger Southern cities looking forward to new construction records this year.

Financially the Federal Reserve Bank of Atlanta reports the Southeastern district in the best shape it has been since 1920.

Export Shipments

There has been a healthy increase during the past few months in export trade out of Southeastern ports for the metal trades industries of the Southeast, according to a report by William Dunn, Jr., secretary of the Southern Metal Trades Association. This business has now reached the largest volume in the past three or four years, and is increasing steadily. Principal buyers at this time are the Latin-American countries, with Cuba, Central America and some of the South American countries taking considerable quantities of Southern iron products. Cuba especially is purchasing large quantities of machinery and supplies of this nature from Southern manufacturers. Considerable machinery, railroad equipment, supplies, etc., are also being shipped from Southeastern ports to more distant foreign countries, with the present outlook giving promise that 1923 will prove one of the best export years Southern metal trades industries have ever enjoyed.

Will Devise Safety Code for Forging

The formulation of a national safety code for the forging industry will be undertaken immediately as a result of the decision of a conference of the principal organizations interested in the subject recently held in New York City on the call of the American Engineering Standards Committee under whose procedure the code will be developed.

The conference by resolution requested that the code include the hazards of drop forging and other hammer forging as well as all hazards peculiar to the forging industry and associated with the machines used in the industry whether or not they occur at the point of operation. The same resolution suggested that the code do not include the hazards of cold extrusion of non-ferrous metals, or hydraulic presses, except as the sectional committee may find it desirable to include small types of the latter, and that the inclusion of hot pressing, bull-dozing, and other forging operations, such as those of bolt-heading and rivet-making machines, be left to the discretion of the sectional committee.

The Safety Code Correlating Committee, that acts in an advisory capacity to the American Engineering Standards Committee, has formally recommended that the code be developed under the joint sponsorship of the National Safety Council and the American Drop Forging Institute.

Decrease in Freight Car Shortage

Shortage in all classes of freight car equipment amounted to 68,986 cars on March 31, which was a decrease of 2,457 since March 22, according to reports recently filed by the carriers with the American Railway Association.

The shortage in box cars totaled 30,849, or a reduction of 2,841 in slightly more than a week, while the shortage in coal cars totaled 29,281, or a reduction within the same period of 634 cars.

At the same time, surplus freight cars in good repair and immediately available for use totaled 14,196 on March 31. This was an increase of 1,455 in slightly more than a week. Surplus box cars in good repair totaled 3,266, an increase of 656 since March 22, while surplus coal cars totaled 3,785 or a decrease of 326 within the same period.

Japanese Industrialist Inspects Big Plant

Y. Yamaka, managing director of the Shinyetsu Hydro-Electric Power Co., Tokyo, Japan, recently visited the plant of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., accompanied by Hikeichi Tsutsumi, manager of Takata & Co., New York, well known Japanese representatives of the electric company.

Mr. Yamaka and Mr. Tsutsumi were conducted through the large shops of the East Pittsburgh works by H. F. Griffith, assistant to the general manager of the Westinghouse Electric International Co., Stephen Q. Hayes, general engineer, who is well known throughout Japan for his work in connection with Japanese power developments for the Westinghouse Co., and Frank D. Newbury, manager of the power engineering department of the Westinghouse Co. and designer of large generators.

During his tour of the plant, Mr. Yamaka inspected large power apparatus being built by the Westinghouse Co. for Japanese power developments, the contracts for which were received by the Westinghouse International Co.

Winslow Blanchard

Winslow Blanchard, president of the Blanchard Machine Co., of Cambridge, Mass., died at his home in Waban, Mass., April 7, after an illness of some months. He was born in Dorchester, the son of John W. and Harriet (Chambers) Blanchard, Sept. 24, 1865. He was a graduate of the Institute of

WINSLOW BLANCHARD

Technology in the class of 1888. In his early professional life he served on the engineering staffs of the Boston Heating Co., Boston, and of the Metropolitan Sewerage Commission, but for more than twenty years he had been associated with the company of which he was the head.

He was active and prominent in the trade associations connected with his business. He had held all the chief executive offices of the Boston branch of the National Metal Trades Association, and at the time of his death was one of the three honorary members. He was treasurer of the Associated Industries of Massachusetts, first vice-president of the National Machine Tool Builders' Association, one of the Board of Governors of the Massachusetts Charitable Mechanics' Association, and a member of the Employers' Association of eastern Massachusetts. He was a member of the Engineers' Club of Boston, of the Machinery Club of New York, the Wellesley Country Club and the Waban Neighborhood Club.

He is survived by his wife, two brothers, and his sister.

His death has been a real loss to the machinery industry, where he was well known and universally liked because of his strong personality and his square dealing.

Labor Shortage Reports Investigated

The idea that a labor shortage exists in the United States has recently gained very general currency according to the *Industrial News Survey*. To determine whether or not such a shortage of labor actually exists in the United States, and if so, in what class of labor, in what industries and where, the National Industrial Conference Board undertook to make a survey of the situation. The preliminary results indicate that there is a shortage of labor, although a comparatively small one, amounting on the average to only about 2½ per cent of the total number employed in industry on March 15. Employment is by no means at its peak, and was relatively much greater in 1920. These facts indicate, however, the very considerable effect that a small labor shortage has on the industrial situation. One of the important facts brought out by this inquiry, however, is the general opinion among those closest to the labor situation that the shortage will definitely increase as the demand for farm and other types of outdoor labor increases during the summer. There seems to be very little possibility of immediate relief.

Wage Increase is Given to Steel Workers

Common laborers at the mills of the United States Steel Corp. and its subsidiaries will receive increases of eleven per cent commencing April 16, according to a recent announcement from the corporation. It has also been announced by the Jones and Laughlin Steel Corp. that a similar action has been taken and other independents have followed the example during the week.

A proportional readjustment of the pay of other classes of labor has also been ordered by the United States Steel Corp. The increases were not unexpected in business circles as they have been rumored for some weeks.

Record in Locomotive Output Reached

Shipments of railroad locomotives from the principal manufacturing plants increased to 282 in March, and were the highest since December, 1920, according to figures published by the Department of Commerce from compliations of the Bureau of the Census. Unfilled orders continued to increase and made a new high record at 2,316 locomotives, an increase of 96 during the month. Unfilled foreign orders increased for the first time since last October.

A.E.S.C. Will Appoint Special Committee

At a recent meeting of the American Engineering Standards Committee, the report of the special committee appointed to formulate a plan of handling the subject of preferred numbers was presented by the chairman, Major Jenks. The report was formally accepted and steps will be taken to carry on the investigation by appointing the authorized committee.

New Corporation Will Repair Cars and Locomotives in Midwest

James W. Cain, manager of purchases of the American Short Line R.R. Association, has announced the successful conclusion of negotiations that have been pending for some time with banking interests and the Midwest Engine Corp., Indianapolis, Ind., covering an extensive rebuilding program for locomotives and freight cars. This program will call for the general overhauling of 180 locomotives and the rebuilding of 3,600 freight cars each year for the next five years.

Indianapolis was chosen because of its central location and the fact that labor conditions are thought to be more favorable than in some of the more crowded industrial centers.

The new corporation as successor of the Atlas Engine Works, which was at one time one of the largest builders of stationery steam engines and boilers in the United States, is well equipped for building locomotives and cars.

H. C. May, formerly superintendent of motive power of the Chicago, Indianapolis & Louisville R.R. and the Lehigh Valley R.R., has been elected president of the new corporation. A. J. Canfield, for many years with the Pullman Co. and Canadian Car & Foundry Co., will be in charge of the car department. Ferdinand Barnickol, president of the Indianapolis Drop Forging Co., is chairman of the board of directors, and John Wood is vice-president.

Locomotives and cars needing heavy repairs will be purchased by the class two and three groups of railroads from class one roads through the American Short Line Railroad Association, and rebuilt at the plant of the Midwest Engine Corp. in a manner that will satisfy the banking syndicates as suitable collateral. The short line roads will thus be enabled to provide adequate freight cars and locomotives which, because of high prices for new equipment would have otherwise been difficult. This is the first extensive program for the acquiring and rebuilding of cars and locomotives to be financed on an equipment trust basis.

Chicago Dealers Express Optimism

Machine tool sales in the Chicago District for the first half of April are equal in volume to sales during March. Numerous inquiries are being received and no particular industry or branch of industry appears to predominate in purchases. The automobile and allied industries are not purchasing machine tools to the extent that the size of the industry and its record-breaking activity would lead one to expect. Second-hand and rebuilt machine tools continue in active demand, even some of the railroads and large manufacturers being included among the purchasers of second-hand and rebuilt machinery. Although several large sales have been made, it appears that the bulk of the buying is composed of small orders.

While advance information on the recent general increase in the price of machine tools had a tendency to hurry contemplated purchases, it is stated that numerous users of machine tools are either dubious as to continued prosperity or still maintain the "no buying attitude" of 1921, and continue to use equipment which remains in service on "borrowed time." The opinion has been expressed by able and experienced men of the industry that the time is not far distant when those who are withholding their purchases will be forced to enter the market.

There are consistent rumors that several of the railroads, particularly the Illinois Central and the Union Pacific, contemplate making machine tool purchases in fairly large volume, but that they are making inquiries among a selected few and will not issue lists.

The Chicago office of Brown & Sharpe Manufacturing Co. reports a very good volume of sales of mechanics' tools parts for replacement and repair of machine tools and a satisfactory volume of sales of new machine tools considering present conditions. The Warner & Swasey Co. recently sold eleven turret lathes to the Sloan Valve Co., that is enlarging its manufacturing facilities, and reports that sales for last week in the Chicago district were the most satisfactory they have had this year.

There is plenty of "prosperity news" this week. The stove, radiator and heater manufacturers, as well as textile machine makers, continue to be very busy. Jobbing foundries are increasing their production. Steel plants in the Chicago district are operating at very near capacity in all departments.

Steady Improvement in Cincinnati

Cincinnati machine tool firms report that their business has shown a steady improvement during the past month. Orders have increased gradually until many concerns have found it necessary to add to the number of their employees. Several plants say that the past two weeks have been the busiest in production and the largest in volume of orders for a number of months. One of the best features of the situation is the amount of actual business which is being closed. Orders are especially good for immediate delivery and also for delivery within a period of thirty days. There are a number of local concerns which now have orders on hand that will keep their plants running steadily for several months.

The immediate demand for planers is good, but purchasers are asking for quick delivery. The most noticeable feature about the situation in Cincinnati is the spirit of optimism among the machine tool men. Conditions have improved so much lately that practically every company in the city is finding it necessary to take on additional labor. The demand for tools from the automobile industry is holding up well, while the purchases of large milling machines and lathes are increasing steadily. The amount of building construction which is now going on demands the installation of machinery, thus stimulating present orders. The local iron market is firm with orders rather heavy for immediate shipment. Foundries are having a good volume of business, orders being sufficient to keep the plants in steady operation. Improvement is noted in the mill and factory supply houses.

Business Items

The plant of the Falcon Tin Plate Co., Canton, Ohio, owned by Youngstown interests, has recently been started after a suspension since the first of the year.

The Westinghouse Electric and Manufacturing Co., of Pittsburgh, is soon to start its Sharon plant for the manufacture of transformers, and will begin operations with 1,000 men. The company plans to transfer the manufacture of transformers from its East Pittsburgh plant to Sharon, and H. P. Davis, of East Pittsburgh, will have charge of equipping and operating the new works. The Westinghouse concern acquired the Sharon plant from the Savage Arms Corp. about six months ago.

The American Sheet and Tin Plate Co., of Pittsburgh, is arranging an expansion and improvement program at its plant at Chester, W. Va. The project will consist of the installation of additional equipment, with new buildings and remodeling of present structures, and is estimated to cost close to $150,000. Work will be commenced at an early date.

The Carbon Iron and Steel Co. has completed improvements and repairs at its furnaces at Parryville, Pa., and resumed operations with a force of 100 men, after an idle period of several months' duration. It is expected to develop capacity operations gradually, and additional workers will be employed.

The R. & V. Motor Co., Moline, Ill., for many years manufacturer of gas engines and automobiles, and since 1913 manufacturer of Knight engines for commercial use as well as Knight automobiles, announces a change in its operating policy. Henceforth it will manufacture Knight-six cars exclusively. The commercial four cylinder Knight engine formerly manufactured by this company for the Fifth Avenue Bus Co., and others will be manufactured and sold by the Yellow Manufacturing Co., Chicago.

The Johns Rolling Mills Co., 5454 Dorchester Ave., Chicago, has incorporated with capital of $200,000 to manufacture and deal in iron, steel and other metals. Correspondents, Pringle & Terwillinger, 108 South La Salle St.

The Acme Steel Goods Co., Chicago, reports that business for the first quarter of the present year shows an increase of seventy-five per cent. The last half of 1922 was an exceedingly good period, but it was estimated the volume of orders based on the present rate at which they are coming in, the year 1923 will show an increase in sales of fifty per cent over 1922.

The million dollar plant now under construction is progressing rapidly and it is expected that it will be ready for occupancy sometime in the fall. With the operation of this plant the official declares the output will be increased fifty per cent.

The Federal Products Corp., Providence, R. I., has moved from Harris Ave. to its new plant at 15 Elbow St.

A valve 14 ft. high and weighing 15,000 lb. has just been completed at the plant of the Western Gas Construction Co., Fort Wayne, Ind., for the Carnegie Steel Co., Clairton, Pa.

The Marion Machine, Foundry and Supply Co., Marion, Ind., has increased its capital stock from $375,000 to $1,500,000.

New shops are being built by the Erie R.R. at Hornell, N. Y. They will be completed about July 1, it is announced.

The H. B. Smith Co., Westfield, Mass., has projected a new foundry unit at its north side plant. The company now is operating with a force of 1,100 employees.

Rolls-Royce of America, Inc., Springfield, Mass., has increased its output of automobiles more than ten a week. The enlarged coach works has recently been put in full operation. The selling organization is being strengthened in the various districts throughout the country.

The Auto Metal Body Corp., Springfield, Mass., has taken a contract to produce bodies for the Checker Cab Co., New York and Chicago.

The Smith & Wesson Co., firearms manufacturer, Springfield, Mass., has increased the wages of its employees 10 per cent.

Passman Bros. will move their headquarters from 28 South Green St. to 705 West Washington Boulevard, on May 1. They carry a line of pulleys, shafting and hangers and will maintain their yard at 27 South Peoria St.

The Rolled Thread Die Co., Worcester, Mass., has been formed by E. Howard Reed and M. Clifton Nelson.

Henry Disston & Sons, Inc., Philadelphia, will have an exhibit at the Foundrymen's Convention to be held from April 30 to May 3 in Cleveland, Ohio.

The American Insulated Wire & Cable Co,. Chicago, is now manufacturing magnet wire, having commenced operations April 1, according to a recent announcement.

Business at the plant of S. F. Bowser & Co., Fort Wayne, Ind., is 118 per cent ahead of the same period last year, according to an announcement made at a company dinner recently given.

The entire stock of mechanical seamless steel tubes of the U. T. Hungerford Brass & Copper Co., New York, has been purchased by Peter A. Frasse & Co., New York.

The Pennsylvania Flexible Metallic Tubing Co., Philadelphia, has moved its Chicago office from 122 South Michigan Boulevard to 11 South Desplaines St.

The Stanley Belting Co., Chicago, has moved its offices from 40 South Clinton St. to 15 North Jefferson St.

The Chicago office of the Bridgeport Brass Co., Bridgeport, Conn., has been moved from the State-Lake Building to the Wrigley Building.

Officers of the Homer Engineering Co., Canton, Ohio, have been elected as follows: President, F. E. Homer; vice-president, W. A. Bushong, and secretary and treasurer, F. A. Carlisle.

The Hannifin Manufacturing Co., Chicago, Ill., will be represented in Detroit by O. L. and W. H. Chapman.

The Yellow Sleeve Valve Engine Works, Inc., Chicago, has increased its capital stock from $40,000 to $750,000 and increased the number of directors from five to seven.

The Yellow Coach Manufacturing Co., Chicago, has increased its capital stock from $10,000 to $1,000,000 and the number of directors from three to seven. The Yellow Cab Manufacturing Co.'s output has been increased to 950 cabs a month, which is the highest on record. With the addition now being built at Austin and Dickens Ave., Chicago, which is expected to be ready for operations about May 20, the capacity will be increased to about 1,800 cabs a month. It is stated officially that the product is sold seven and one-half months ahead.

A sale of Navy surplus of double iron blocks has been announced by the Central Sales office, Navy Yard, Washington, D. C., and sealed bids will be opened at 11 a. m. April 27 at the Central Sales office.

Personals

F. D. VANAMBRUGH, editor of the *Silent Partner*, was the speaker at a recent meeting of the Ilion Engineers' Club. D. M. STRICKLAND, research engineer of the American Rolling Mills also spoke.

R. L. MORGAN, designer of the "Hydroil" internal grinding machine, manufactured by the Greenfield Tap and Die Corp., Greenfield, Mass., will sever his connection with the corporation on June 1. After that date his address will be 393 Main St., Worcester, Mass.

CLINTON S. DARLING has charge of the Chicago office of the Pennsylvania Crusher Co., Philadelphia. After May 1 his headquarters will be in the Illinois Merchants Bank Building.

CARL A. BAER will have charge of the Philadelphia office of Dwight P. Robinson & Co., engineers, New York.

F. C. BROWN, acting director of the U. S. Bureau of Standards, Washington, D. C., has been appointed a representative of the Department of Commerce on the American Engineering Standards Committee succeeding S. W. STRATTON.

E. V. WENZELL, formerly Chicago representative of the Cincinnati Milling Machine Co., Cincinnati, Ohio, has become associated with the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., as sales manager. The company makes internal grinding machines and boring machines. Mr. Wenzell will make his headquarters at Fond du Lac. Wis.

WILLIAM C. STRAUB has succeeded Nelson B. Gatch as manager of the New York district of the Chicago Pneumatic Tool Co., New York.

O. L. CHAPMAN and W. H. CHAPMAN, formerly of the Davis Boring Tool Co., St. Louis, Mo., have been appointed secretary and treasurer, respectively, of the Firmhill Machine Supply Co., Detroit, Mich., succeeding C. C. FIRMIN.

JOHN ATKINSON has been promoted to manager of the service department of the Westinghouse Electric & Manufacturing Co., Buffalo district.

E. L. DOTY, former manager of the service department of the Westinghouse Electric & Manufacturing Co., Buffalo district, has been promoted to engineering assistant in the service department at the East Pittsburgh plant.

J. B. WARREN was elected president of the Penn Seaboard Steel Corp., Philadelphia, recently.

J. P. BARNUM, formerly assistant sales agent of the Union Drawn Steel Co., Beaver Falls, Pa., with headquarters in New York City, has been promoted to eastern sales agent.

ROBERT F. EISSLER, formerly assistant to the vice-president of the Chicago Pneumatic Tool Co., New York, has assumed his former position of manager for the company in the Pittsburgh district at his own request.

NELSON B. GATCH, formerly district manager of the New York district of the Chicago Pneumatic Tool Co., New York, has been appointed assistant to the vice-president of the company.

JOHN SCANLON has been appointed superintendent of the tin house of the Farrell plant of the American Sheet and Tin Plate Co., succeeding BAKER BOYD.

E. J. MCCARTHY, for several years secretary to C. L. Miller, vice-president American Steel and Wire Co., Pittsburgh, has been assigned to the office of George W. Jewett, in charge of operations at the wire mills in the Pittsburgh district.

R. W. WILLIAMS has been appointed Southwestern district manager for both the Westinghouse Airbrake Co. and the Westinghouse Traction Brake Co., of Wilmerding, Pa., with headquarters in St. Louis. The last named company has also announced Mr. Williams' election as vice-president.

G. J. ECKER, for the past twelve years factory manager at the Detroit Gear and Machine Co., Detroit, Mich., has resigned.

Obituary

CHARLES A. MAHER, aged 51 years, died recently at his home in Cleveland. Mr. Maher was the first vice-president of the National Car Wheel Co. of that city.

FREDERICK S. MARTIN, aged 60 years, died recently at the West Penn Hospital, Pittsburgh. Mr. Martin was staff superintendent of the Westinghouse Electric and Manufacturing Co., East Pittsburgh.

THOMAS C. DEROSSETT, eastern sales manager of the Symington Co., Baltimore, Md., died recently in that city.

ERNEST MILLS, aged 49 years, died recently at his home in Cincinnati, Ohio. Mr. Mills was vice-president of the Smith & Mills Co., manufacturer of shapers, Cincinnati, Ohio.

WATSON R. SMITH, manager of the Hi-Power Tool Co., Jackson, Mich., died recently at his home in that city.

News of Washington Activities

BY PAUL WOOTON

The Treasury department has issued an order imposing a duty of 35 per cent ad valorem on automobile wheels complete with nuts, bolts, rims and caps when imported from Canada. The duty in the United States tariff is twenty-five per cent, with a proviso that if any other country imposes a higher duty on such imports from the United States, a countervailing duty not to exceed fifty per cent shall be imposed against that country. The Canadian duty on complete automobile wheels from the United States is 35 per cent; hence the Treasury Department's orders to conform with the meaning of the tariff laws.

Federal officials, generally, express disappointment that the American Society of Civil Engineers should have voted against joining the Federated American Engineering Societies. While they are inclined to accept the contention that the practical functioning of the federation probably can be conducted more smoothly and effectively without having to consider the views of the national officers of the Civil Engineers, they recognize that favorable action by the Civil Engineers would have had an important moral influence.

Suggesting that the Toledo Scale Co., Toledo, Ohio, has placed itself in a position of contempt of the Seventh Circuit Court of Appeals by seeking an injunction in the United States District Court for northern Ohio to enjoin enforcement of a decree of the Circuit Court, the United States Supreme Court recently affirmed the Circuit Court decision which had upheld that of the northern Illinois District Court to the effect that the Toledo Co. had infringed a patent owned by the Computing Scale Co., Dayton, Ohio.

Contractors on construction work for the Government where the contracts include a penalty clause for delay are not excused from paying the penalty even though additional delay in completing the project may be caused by the Government itself, according to a decision rendered by the Supreme Court recently.

ON CONTRACT WORK

The case was a suit instituted by Roy H. Robinson, administrator of the estate of John C. Robinson, versus the United States. Robinson in 1905 had a contract to install the interior finishing of the New York Customs House.

In its decision, the Supreme Court ruled: "The fact that the Government's action caused some of the delay presents no legal ground for denying it compensation for loss suffered wholly through the fault of the contractor." The decision of the Court of Appeals was affirmed.

Anticipated and probable profits not realized because of cancellation of war contracts by the Government, cannot be recovered from the Government, according to recent rulings of the United States Supreme Court, sustaining the Court of Claims. The Court further held that the law authorizing the President to change or annul contracts properly should have been considered when such contracts were first made.

The decision was in the case of the Russell Motor Car Co. against the United States. The company had a contract with the Navy Department for anti-aircraft gun mounts. On Nov. 18, 1918, the Department notified the company to greatly decrease production and to resume the output of peacetime products as soon as possible. On Nov. 23 the Department cancelled the contract, effective Dec. 2. After lengthy negotiations, the Secretary of the Navy finally declared $444,874 was due the company as compensation for the cancelled contract. The company claimed that it would have made a profit greatly in excess of this sum, and sued the Government in the Court of Claims. That Court declared $495,250 to be due the company. This decision was upheld by the Supreme Court.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb.....	$0.0326	$0.0322	$0.0229
Cold finished shafting.....	per lb.....	0.0406	0.0406	0.035
Brass rods.....	per lb.....	0.1913	0.1870	0.1533
Solder (½ and ½)	per lb.....	0.30	0.2833	0.20
Cotton waste..	per lb.....	0.1231	0.1181	0.104
Washers, cast iron (½ in.)...	per 100 lb.	4.66	4.33	3.83
Emery, disks, cloth, No. 1, 6 in. dia.....	per 100.....	2.96	2.96	3.11
Lard cutting oil	per gal.....	0.575	0.5575	0.608
Machine oil....	per gal.....	0.349	0.349	0.40
Belting, leather, medium.....	off list.....	42%	49%	48½%
Machine bolts up to 1 x 30 in.	off list.....	44¼%	51½%	64½%

Gain in Unfilled Steel Orders

The United States Steel Corp. issued its monthly statement of forward business on its books as of March 31 recently. It showed an increase of 119,343 tons in unfinished business and brought the total up to 7,403,332 tons, the largest total reported for any month since January, 1921. The present total compares with 7,283,989 tons at the end of February and with 4,494,148 tons on March 31 last year.

March Steel Production Highest Recorded

A new high record in steel ingot production was made in March when the output was 3,402,007 gross tons. In February the total production was 2,219,017 tons and a year ago March the output was estimated at 2,370,751 gross tons. The output during March was divided as follows; open hearth, 2,656,134 tons, Bessemer, 742,564 tons, all others, 3,309 tons. April business is expected to show further substantial gains.

American Automobiles in South America

The years 1914 and 1915 were bad ones in the Argentine automobile business, as the supply of French cars had been stopped and the American higher-priced car had not yet made any impression. After 1916, however, the activity of American car agents increased so that by 1919, before the European manufacturers were able to get back into the field, at least a half dozen American makes of medium and high priced cars were well known in Argentina. The success of the campaign can really be attributed to two or three American medium-priced cars, whose agents established repair and supply stations in Buenos Aires. These stations were accepted as a guaranty of service and good will and proved to be a sales feature for the cars.

In the meantime the American low-priced automobile, especially one particular make, was gaining in popularity for country use, and the sales were doubling annually. These cars were getting severe service on the bad roads of the pampa, were being left out in the open exposed to the weather, and were being driven by farmers with no knowledge of machinery of any kind. Another record was reached in 1916 with a total importation of 5,929 cars, but the following year imports nearly doubled. The total in 1917 reached 11,031 cars, of which 10,930 came from the United States and 50 from Canada. More than half of these cars were the light, low-priced automobile. In 1918 the manufacturer of this car established an assembling plant in Buenos Aires and began shipping the manufactured component parts in quantity from the United States. In this way he was able to save part of the import duties and at the same time add an additional selling point by featuring a "national industry."

Better Rail Conditions In New England

The special committee appointed by New England Governors to investigate the railroad situation has found conditions "far from hopeless." It believes there are prospects of a broader market for New England than the section has ever before enjoyed and is still of an open mind in the question of consolidating New England lines in one system or of merging with trunk lines, James J. Storrow, chairman of the committee, told the Massachusetts Chamber of Commerce recently. The committee has virtually completed its preliminary inquiry, he said, but has not undertaken the formulation of its conclusions.

The physical conditions of the roads, as far as tracks, bridges and ordinary buildings are concerned, was found to be excellent. Motive power and equipment, however, on many of the roads are not as good as they should be, Mr. Storrow said. More attention must be paid to traffic routes, he stated.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

(Copyrighted. Theodore H. Price Publishing Corporation, 16 Exchange Place, New York)

OF THE railroads it has been recently remarked that they are investing much money in new equipment and improved facilities because they are "menaced with prosperity." The same thing might be said of business generally in the United States. Because they are menaced by prosperity the steel manufacturers have been compelled to grant an advance of 11 per cent in wages. The General Electric Co. has "ordered its joint conference committee to consider a readjustment in the wage scale" and all over the country employers are finding that they must pay more or lose their help.

The result will, of course, be higher costs and higher prices to meet which a further advance in wages will be demanded, and so we shall follow the vicious spiral upward until we reach the top and are forced to jump off or retrace our steps. Just which alternative will be selected no one can predict, but during the last few years the business men of the United States have been attending a school of applied economics and it is at least reassuring that most of them now understand that we must soon reach a point at which activity will be halted by high prices.

There are, in fact, some indications of a slowing down already. They are not yet reflected in statistics, but there are a good many who report a slackening in the demand for what they have to sell. Thus, an out of town manufacturer of furniture telephoned me the other day to ask me if I could explain why his sales in the Eastern cities were so small, and more than one distributor of dry goods has reported that his orders are now accepted and filled with unusual and surprising promptitude.

The automobile manufacturers continue to advertise a record production, but the fact that the Ford dealers are offering to sell a car for $160 cash down and the balance at the rate of "89 cents a day" is construed by some as indicating that the "motor market" has at last reached the long predicted "saturation point."

There are a few other straws whose diminished speed of movement may mean that the tide is about to turn, but they are being closely watched and it is at least gratifying to feel that no one will be shocked or surprised when the ebb sets in.

Most of the commodity markets have been featureless, but a sharp advance in wheat has followed a Government report indicating a reduction of 80 million bu. in the yield of winter wheat. Corn improved sympathetically, but cotton has afforded a fresh demonstration of "the unwisdom of bulling the tail end of a small crop."

Coffee and sugar have been alternately weak and strong, sugar sold last week at the highest level since 1920 but there is some question whether the price can be maintained. Copper is slightly easier at 17¼ cents and the indisposition to buy steel except for prompt delivery continues, being probably the result of the abandonment of building that has followed the late advance in wages.

On the Stock Exchange the prices of most securities have declined. There are some exceptions, but not many. The weakness of the railroad stocks has been really surprising in view of the large traffic and record car loadings reported. It is, perhaps, explained by the fear that the roads are burdening themselves unduly with equipment trust obligations in order to provide the rolling stock and motive power that they need, but there is also a feeling that the farm bloc in the next Congress may be able to carry out its threat to reduce rates. Good bonds have now reached a point at which they ought to be attractive investments unless the money market advances further, of which there is no present indication as the Federal Reserve statement shows a gain of $16,000,000 in the gold held and a reserve ratio of 76.3 per cent as against 75 a week ago.

> "There are, in fact, some indications of a slowing down already. They are not yet reflected in statistics, but there are a good many who report a slackening in the demand for what they have to sell. . . The automobile manufacturers continue to advertise a record production, but the fact that Ford dealers are offering to sell a car for $160 cash down and the balance at the rate of 89 cents a day is construed by some as indicating that the saturation point has been reached."

The announcement that the name of Henry Ford will be formally placed on the primary ballot of the Progressive Party in Nebraska as its candidate for President and that he will be the candidate of the American Economic League in many other States has caused concern in some quarters, as the aims of the Economic League as stated in its charter include the economic stabilization of the United States through the establishment of a debt paying system of finance, in place of the debt creating Federal Reserve Bank System, and a soldier bonus by the direct issue of full legal tender currency from the Government.

But it remains to be seen whether the Ford-for-President movement will really acquire enough projectile power to force the nomination of its candidate. If it does the best idea of its probable effect can probably be found in the record of 1896, when the fear of Mr. Bryan's election on a fiat money platform resulted in an acute depression of prices.

The news from Europe continues to discourage those who had hoped that the spring would bring tranquility. In pursuing the *ignis fatuus* of the reparations the French are being drawn farther and farther into Germany, and the execution of Vicar General Butchkavitch has revived the bitterness generally felt toward the Soviet government of Russia.

Many news dispatches insist that Lenine is dying and that he has been entirely superseded by a group who are already quarreling among themselves over a division of the political spoils.

In England the Bonar Law ministry has narrowly escaped defeat and the complete domination of the labor party is predicted.

But one consequence of the disorder that exists abroad is that America is coming to feel that self interest will shortly make it necessary for Uncle Sam to assert himself in straightening out conditions overseas. This is indicated by the outgivings of Senators Pepper and Capper.

If the result shall be our aggressive co-operation with Great Britain in sterilizing the seeds of another war that have been recently sown, it is quite possible that the influence upon business would be stimulating, and it is in this direction that I look most hopefully for the sunshine that will dispel the fog that now overhangs our export trade.

Metal Exchange Has New Trading Hour

The call on the New York Metal Exchange will be changed April 23 from 12.30 to 3.30 p.m., according to notices that have been sent out to members. It is expected that more satisfaction will be the result of this new hour as it has been complained in the past that real trading cannot be accomplished until late afternoon when members are thoroughly conversant with existing conditions.

Petroleum Testing to be Standardized

The standardization of methods of testing petroleum products and lubricants will be developed by a sectional committee under the sponsorship of the American Society for Testing Materials, as a result of recent action by the American Engineering Standards Committee.

Economic Problems to be Discussed

American business, big and little, as represented in the nationwide membership of the Chamber of Commerce of the United States, is to be given the direct opportunity to express its views with regard to the proposals of the International Chamber of Commerce for solution of the reparations and other European economic problems. National Chamber officials announced recently that the resolution unanimously adopted at Rome favoring an international financial conference to this end, had been placed on the agenda of the forthcoming Annual Meeting of the National Chamber, May 7-11, in New York. It is expected much interest will be shown on these subjects.

Book Reviews

Five Thousand Plain Answers to Direct Questions on Steam, Hot Water, Vapor and Vacuum Heating. Second edition—revised and enlarged. By Alfred G. King. Published by the Norman W. Henley Publishing Co., 2 West 45th St., New York City. Cloth; 6x9 in.; two hundred and fifty-three pages; one hundred and fifty-seven illustrations and twenty-eight tables. Price $2.50.

As an intensely practical, easily understood and up-to-date book on heating, this volume should be in the library of the operating engineer whose work involves the operation of any type of heating system. Such work ordinarily includes not only the actual operation of a system already installed, but the occasional installation of additional equipment and the rearrangement of existing equipment to meet the needs of a growing plant. The last few years have witnessed a marked advance in the technique of heating, and the engineer must be thoroughly familiar with the latest practice if he is to do full justice to his job.

Good as is the information contained, the method of presentation will appeal quite as much to the busy practical man. Starting with the elements, the book proceeds with a series of simple and well chosen questions such as a man looking for useful knowledge would ask of an expert who was willing to give him a day of two of his time. The answers are equally simple and direct.

Accurate Tool Work. By C. L. Goodrich and F. A. Stanley. Second edition, second impression. Two hundred and eighty-one 6x9 in. pages, cloth boards. Three hundred and twenty-seven illustrations. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York City. Price $3.

A book that every toolmaker should be proud to include as one of his tools. It gets right down to details on how to do accurate work in the making of jigs and fixtures, gages and other special manufacturing tools.

The work of the toolmaker is today much greater in scope than it was a few years ago, just before the war. The immense quantities of machines and other products demanded by the warring nations made necessary their manufacture on a production basis by the use of jigs, fixtures and special tools. Interchangeability, demanded in almost all classes of machinery, was another influence for accuracy. The importance of the gage for checking after successive manufacturing operations and as an inspection tool was accentuated. It was by the several agencies mentioned that the toolmaker became a necessary part of almost every shop instead of being confined to a few.

Locating and boring holes is given a great deal of attention, as the subject deserves. Master plates are taken up in detail. The use of the microscope, the laying out of angles, the sine bar and gage blocks are some of the other subjects treated. There is a section devoted to trigonometry in the tool room.

A book that could be used merely as a reference on such subjects would be considered good. The additional value of this volume lies in the fact that it is a book of instructions as well as reference.

Metals and Their Alloys. By Charles Vickers, Technical Adviser to Manufacturers of Non-Ferrous Castings; Non-Ferrous Editor of *Foundry*; and Metallurgical Editor of *Brass World*. Seven hundred forty-five 6x9 in. pages, one hundred ten illustrations, many engravings. Published by Henry Carey Baird & Co., Inc., 2 West 45th St., New York City. Price $7.50.

This book is partly based on the third edition of "Metallic Alloys" by William T. Brannt. It deals with metals from their origin to their useful application and constitutes practically a new book. Presentation is clear and simple, easily understood by anyone having need for its use—owner, manager, metallurgist, chemist or shopman.

Many formulas are given, particularly in the chapters on the casting of copper, the making of manganese bronze, aluminum bronze, aluminum alloys, red brass, yellow brass, steam metals and nickel alloys. Information on physical properties and the casting peculiarities is included.

Valuable chapters are those on magnesium alloys, die casting, Monel metal, soft solders and brazing alloys, surface coloring of alloys, foundry uses of scrap metals, and those on brass.

Those interested in the origin and physical properties of the elements of the methods of obtaining them from their ores and of refining them, and their market forms, will find this information in the first part of the book. This section leads up to the discussion of the alloys, which are divided into twelve classes, each with a different metal as base and which include iron and steels and also alloys having zinc as a base.

The extent of the field covered has made necessary a large book. It is to the credit of the author that he did not try to compress into fewer pages the wealth of practical information that he has furnished.

Catalogs Wanted

Johnstone & Chapman, consulting engineers, surveyors and valuers, 9 Old Post Office St., Calcutta, India, want catalogs and price quotations on metal and woodworking machinery suitable for factories engaged in the production of munitions, rifles and other war supplies.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Single swift cotton-carding machine used for the purpose of wadding manufacture. Australia. Purchase. Specifications, catalogs and illustrations desired. Terms, Cash against documents. Reference No. 5936.

Machinery for manufacturing "note rolls" used for mechanical musical instruments. Germany. Purchase. Quotations, c.i.f. Antwerp. Terms, Cash. Reference No. 5937.

Tractor suitable for drawing both light and heavy plows. Portuguese East Africa. Purchase. Catalogs and full information requested. Reference No. 5938.

Machine tools. France. Purchase or agency. Terms, Cash for purchases. Catalogs are desired. Reference No. 5939.

Small ice-making machine of five-family capacity, preferably operated by gasoline engine. Azores. Purchase. Quotations, c.i.f. Azores port. Terms, Cash against documents in United States bank. Reference No. 5940.

Knitting machines for home use. Denmark. Manufacturers' agency. Reference No. 5941.

Machinery for printing inks, and machinery for the manufacture of stationery. India. Purchase. Quotations, c.i.f. Bombay. Terms, Cash. Reference No. 5942.

Rice-milling machinery. India. Purchase. Quotations, c.i.f. port of Burma. Reference No. 5943.

Modern machinery for refining twenty-four tons of raw sugar each twenty-four hours including centrifugals, filtering presses and cube-making machinery. Brazil. Purchase. Quotations, c.i.f. Brazilian port. Terms, cash against documents. Reference No. 5944.

Building machinery. Italy. Purchase. Reference No. 5945.

Machines for making pulpboard pails. Canada. Purchase. Reference No. 5946.

Automatic wire-weaving machines, suitable for the woven-wire mattress manufacture. England. Purchase. Quotations c.i.f. English port. Reference No. 5947.

Machinery for roasting and grinding two and a half tons of coffee each twenty-four hours., using existing transmission; paper bag-making machinery. Brazil. Purchase. Quotations, c.i.f. Brazilian port. Terms, cash against documents. Reference No. 5948.

Machine for making soda straws. Canada. Purchase. Reference No. 5949.

Engineering and mining machinery. South Africa and Rhodesia. Exclusive agency. Quotations f.o.b. American port. Terms, Payment against document. Reference No. 5968.

Machine tools, small tools, iron and steel articles of all sorts, Denmark. Agency. Quotations, c.i.f. Danish port. Terms, cash against documents. Reference No. 5999.

Aluminum pistons, bolts and nuts, fan belts, cheap light jacks, automobile clocks, and non-breakable hydrometers, Australia. Agency desired by the representative in United States. Reference No. 6004.

Forthcoming Meetings

National Metal Trades Association. Twenty-fifth annual convention to be held at Hotel Astor, New York City, April 18 and 19. L. W. Fischer, secretary.

Society of Industrial Engineers, Spring convention at Hotel Gibson, Cincinnati, Ohio, April 18 to 20. Secretary, George C. Dent, 327 South La Salle St., Chicago, Ill.

American Gear Manufacturers' Association. Seventh annual meeting April 19, 20 and 21, Hotel Cleveland. Cleveland, Ohio.

American Welding Society, annual meeting. Engineers' Building, New York City, April 24 to 27.

National Foreign Trade Council. Annual meeting at the Grunewald Hotel, New Orleans, La., May 2, 3 and 4, 1923. O. K. Davis, Secretary, 1 Hanover Square, New York City.

American Foundrymen's Association. Annual convention, and exhibition at Public Hall, Cleveland, Ohio, April 30 to May 3, 1923. C. E. Hoyt, 140 South Dearborn St., Chicago, is secretary.

American Electro Chemical Society, Semi-annual meeting, Hotel Commodore, New York City, May 3 to 5, 1923. Colin G. Fink, 327 South La Salle St., Chicago, Ill., is secretary.

National Chamber of Commerce. Annual meeting, New York City, May 7 to 10. Julius Barnes, president.

American Association of Engineers. Annual convention, Norfolk, Va., May 7 to 9. C. E. Drayer, 63 East Adams St., Chicago, Ill., secretary.

National Association of Manufacturers. Annual convention, Waldorf-Astoria Hotel, New York City, May 14-15-16. General offices, 50 Church St., New York City.

National Association of Purchasing Agents. Annual convention, Cleveland, May 15 to 18. H. R. Heydon, 19 Park Place, New York City, secretary.

National Supply and Machinery Dealers' Association; Southern Supply and Machinery Dealers' Association; and the American Supply and Machinery Manufacturers' Association, triple convention, in Cincinnati, Ohio, May 17, 18, 19, 1923. F. D. Mitchell, 1819 Broadway, New York City, is secretary.

American Society of Mechanical Engineers. Spring meeting at Montreal, Can., May 28 to 31. Calvin W. Rice, 29 W. 39th St., New York City.

American Society for Testing Materials. Annual meeting at Atlantic City, June, 1923. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary.

Society of Automotive Engineers. Summer Meeting. Spring Lake, N. J., June 19 to 23.

American Society for Steel Treating. Eastern sectional meeting, Bethlehem, Pa., June 14 and 15. Hotel reservations through George C. Lilly, Superintendent of Heat Treatment, Bethlehem Steel Co., Bethlehem, Pa.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Steel bars firm at $2.50 per 100 lb., Pittsburgh, with extreme quotations of $2.75, frequently made for prompt deliveries. Plates and shapes still stronger and higher than bars; minimum price, $2.45, maximum, $2.75@$2.85, owing to premiums demanded for spot shipments, due to rush of production. Ship and tank plate consumers and steel fabricators taking bulk of tonnage. Galvanized steel sheets up 25c. per 100 lb., f.o.b. Pittsburgh. Discounts on rivets, bolts, nuts, washers, etc., reduced five to ten points in New York warehouses. No. 2 foundry pig iron $33, against $32 in Chicago and $32, up from $31 per ton in Pittsburgh, including freight from valley. Copper sheets up ¼c. in Cleveland and ½c. per lb. in New York. Copper wire ¼c. higher in New York. Raw linseed oil (5 bbl. lots) $1.16, f.o.b. New York, against $1.13 per gal., one week ago. Discounts lower on rubber and duck belting.

Declines—No improvement in copper demand; price down ½c. per lb., in week. Both lead and zinc declined 15c. per 100 lb.; antimony also lower. Slight reductions in solder and zinc sheets in New York and in first grade babbitt metal in Cleveland.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$31.55
Northern Basic	32.27
Southern Ohio No. 2	33.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	34.94
BIRMINGHAM	
No. 2 Foundry	27.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	33.76
Virginia No. 2	34.17
Basic	30.75
Grey Forge	31 00
CHICAGO	
No. 2 Foundry local	33.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	33.01
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	32 00
Basic	31.00
Bessemer	31.00

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.0
Cleveland	5½@6¼
Cincinnati	4@6
New York	5½@5¾
Chicago	4@5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.65@3.25	4.34	3.90	4.15
No. 12	2.75@3.35	4.39	3.95	4.20
No. 14	2.85@3.45	4.44	4.00	4.25
No. 16	3.05@3.65	4.54	4.10	4.35
Black				
Nos. 17 and 21	3.35@3.85	4.70	4.55	4.85
Nos. 22 and 24	3.40@3.90	4.75	4.60	4.85
Nos. 25 and 26	3.45@3.95	4.80	4.65	4.90
No. 28	3.50@4.00	4.90	4.75	5.00

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11	4.00@4.50	4.90	4.80	5 10
Nos. 12 and 14	4.10@4.60	5.00	4.90	5.2
Nos. 17 and 21	4.40@4.90	5.30	5.20	....
Nos. 22 and 24	4.55@5.05	5.45	5.35	5.65
No. 26	4.70@5.20	5.60	5.60	5.80
No. 28	5.00@5.50	5.90	5.90	6.10

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel BUTT WELD Inches	Black	Galv.	Iron Inches	Black	Galv.
1 to 3	64	52½	⅜ to 1½	30	13
LAP WELD					
2	57	45½	2	23	7
2½ to 6	61	49½	2½ to 4	26	11
7 to 8	58	45½	4½ to 6	28	13
9 to 12	57	44½	7 to 12	26	11
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	62	51½	⅜ to 1½	30	14
2 to 3	63	52½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	55	44½	2	23	9
2½ to 4	59	48½	2½ to 4	29	15
4½ to 6	58	47½	4½ to 6	28	14
7 to 8	54	41½	7 to 8	21	7
9 to 12	48	35½	9 to 12	16	2

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	54%	41%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded	51%	38%	53½%	40½%	59½%	45½%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 5%. Cast iron, standard sizes, 25% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.69	4.51	4.55
Cold rolled strip steel	7.00	8.25	7.25
Floor plates	5.65	5.46	5.80
Cold finished shafting or screw	4.20	3.90	4.30
Cold finished flats, squares	4.70	4.40	4.80
Structural shapes (base)	3.44	3.31	3.30
Soft steel bars (base)	3.34	3.21	3.22½
Soft steel bar shapes (base)	3.34	3.21	3.22½
Soft steel bands (base)	4.14	3.61	3.95
Tank plates (base)	3.44	3.31	3.30
Bar iron (3.25 at mill)	3.34	2.91	2.92½
Carbon tool steel	11.00	....	....
Drill rod (from list)	55%	40@55%	50%
Electric welding wire:			
5/32	8.50		14.00
1/8	7.35		12.25
5/32 to 1/4	7.10		11.00

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			17.75
Tin, 5-ton lots, New York			47.50
Lead (up to carlots), St. Louis	8.20;	New York.	8.72½
Zinc (up to carlots), St. Louis	7.50;	New York.	7.95

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	26.20	28.00	28.50
Antimony (Chinese), ton spot	9.60	11.50	10.50
Copper sheets, base	26.50	25.75	23.00
Copper wire (l.c.l.)	19.87½	22.00	16.25
Copper bars (l.c.l.)	23.75	25.25	19.50
Copper tubing (l.c.l.)	28.00	30.25	23.00
Brass sheets (l.c.l.)	21.75	25.25	18.75
Brass tubing (l.c.l.)	26.50	30.75	20.50

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (l. c. l.)	20.00	22.25	15.75
Brass wire (l. c. l.)	22.25	22.00	.....
Zinc sheets (casks)	11.00	11.25	.....
Solder (½ and ½), (caselots)	34.00	32.00@34.00	20.00
Babbitt metal (83% tin)	65.00	58.00	36.00
Babbitt metal (35% tin)	40.00	18.50	.....
Nickel (ingot and shot), Bayonne, N. J.	29.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	32.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	55
Hot rolled rods, Grade "A" (base)	50
Cold drawn rods, Grade "A" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled rods "E"—low manganese (base)	54
Manganese nickel hot rolled rods "D"—high manganese (base)	57

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	46.00
Hot rolled sheets (base)			45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	14.75@15.25	14.00	15.50
Copper, heavy, and wire	14.50@15.00	13.50	14.50
Copper, light, and bottoms	12.50@13.00	12.00	13.50
Lead, heavy	6.25@ 6.75	6.50	7.25
Lead, tea	5.75@ 6.00	5.00	6.25
Brass, heavy, yellow	8.75@ 9.00	....	9.25
Brass, heavy, red	12.25@12.75	12.00	12.50
Brass, light	7.25@ 7.75	7.50	8.25
No. 1 yellow brass turnings	8.75@ 9.00	8.50	9.00
Zinc	5.00@ 5.50	4.50	4.75

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	22.00	18.25	18.50
IX,	20x28, 112 sheets	24.50	21.00	20.90
"A" Grade:				
IC,	20x28, 112 sheets	19.50	16.00	17.00
IX,	20x28, 112 sheets	22.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	13.00	12.20	14.50
IC,	112 sheets	13.30	12.60	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	6.30	7.25
IC,	14x20	7.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13	$0.15	$0.11½
Cotton waste, colored, per lb.	.07@.12	.12	.08
Wiping cloths, 13½x13½, per lb.	.16	36.00 per M	.10
Wiping cloths, 13½x20½, per lb.	.20	52.00 per M	.13
Sal soda, 100 lb. lots	2.65	3.50	2.65
Roll sulphur, per 100 lb.	2.90	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	1.16	1.10	1.25
White lead, dry or in oil	100 lb. kegs.	New York,	14.25
Red lead, dry	100 lb. kegs.	New York,	14.25
Red lead, in oil	100 lb. kegs.	New York,	15.75
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton	$7.25@7.75	
Coke, prompt foundry, Connellsville	per net ton	8.25@8.30	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	30%	50-10%	45-5%
1½ and 1¼x3 in. up to 12 in.	15%	50%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	15%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	20%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	.....
Hex. head and hex. nut bolts	List net	.....	65-5%
Lag screws, coach screws	30%	.....	60-5%
Square and hex. head cap screws	60%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	25%	45%	40-5%
Bolt ends, with hot pressed nuts	30%	.....	55%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, 7/16 and smaller	60%	.....	.....
Semi-finished nuts, ½ and larger	55%	65-10%	80%
Case-hardened nuts	40%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$3.50
Washers, cast iron, ⅜ in., per 100 lb. (net)	5.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	1.50	4.50	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	List net	2.75	2.50
Nuts, hot pressed, hex., per 100 lb. Off list	List net	2.75	2.50
Nuts, cold punched, sq., per 100 lb. Off list	List net	2.75	2.50
Nuts, cold punched, hex., per 100 lb. Off list	List net	2.75	2.50
Rivets:			
Rivets, 7/16 in. dia. and smaller	40%	50-10%	50%
Rivets, tinned	40%	50-10%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$5.50	$3.90	$3.75
Cone heads, ditto (net)	5.60	4.00	3.85
1¼ to 1¾-in. long, all diameters, *EXTRA* per 100 lb	0.25	.....	0.15
¾ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.70 base

Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.297	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin. ft., $2.88:			
Medium grade	30-10%	40½%	50%
Heavy grade	20-5-2½%	30-5%	40-5%
Rubber and duck:			
First grade	50-10-5%	50-10%	40-10%
Second grade	60-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.,			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

Ill., Chicago—T. E. Braley, 2411 East Douglas Ave. (garage and manufacturer of parts)—six 11 in. machine lathes, air compressor and motor equipment.

Ind., Marion—Marion Machine Fdry. & Supply Co.—power rotary shear.

Ia., Waterloo — Silvers Mfg. Co. — enameled sheet metal working equipment.

Kan., Caldwell—The Messenger (newspaper)—power punch.

Kan., Wichita—BeIsle & Girard,107 West Douglas Ave. (manufacturer of pipe organs) —power lathe and drill press.

Kan., Wichita—C. & D. Storage Battery Sta., 1008 West Douglas Ave., (manufacturer of batteries), C. G. Dickerson, Purch. Agt.—drill press for power attachment.

Kan., Wichita—Dodson Concrete Board Co., 602 North Anthony St.—power press, line shafting and power emery stand.

Kan., Wichita—Jones Blacksmith Shop, 116 Pattie St., P. D. Jones, Purch. Agt.—blacksmith drill press.

Kan., Wichita—West Side Garage, 900 West Douglas Ave., W. M. Tosbaugh, Purch. Agt.—power lathe and arbor press.

La., New Orleans—New Orleans Sheet Metal Wks., 1106 North Rampart St.—prices on 3 x 36 in. rollers; 10 ft. brake; thick edger, 2¼ in. wheel; pipe cripping machine, 2¼ in. wheel; swedging machine 2 x 15 in. (new or used).

Mass., Boston — Saco-Lowell Shops, 77 Franklin St. (manufacturer of textile machinery), address Purchasing Agent—metal working machinery, including lathes, planers, drills, shafting, etc., for new plant at Charlotte, N. C., possibly machinery for plant at Newton Upper Falls.

Mass., East Boston (Boston P. O.)—Bethlehem Ship Bldg. Corp., Simpson's Patent Drydock Plant, J. Davidson, Genl. Mgr.—large and small metal working tools, to increase capacity of plant (new or used).

Mich., Marquette—Upper Michigan Motors Corp.—automobile repair machinery, equipment for charging batteries several ton press, oil pumps and tanks for proposed $60,000 garage.

Mo., Joplin—Mchy. & Supply Corp., 211 East 4th St. (mining machinery), J. V. Henry, Purch. Agt.—8 in. pipe cutting machine, also small size bolt machine (used).

N. Y., Adams—Shelmidine-Moore Corp. (garage and machine shop), R. W. Moore, Purch. Agt.—24 x 24 in. x 5-ft. tool room planer.

N. Y., Bath — Bartrom & Hallenbeck (Overland garage), G. F. Bartrom, Purch. Agt.—lathe, shaper and drill press for motor repairs.

N. Y., Binghamton—W. D. Sweet, 140 Chapin St.—machinery, tools and equipment for garage, to replace that which was destroyed by fire.

N. Y., Buffalo—E. Ahr & Son, 1512 Main St., F. W. Ahr, Purch. Agt.—equipment and one 1,000 gal. gasoline tank and pump for service station on Bailey and Walden Aves.

N. Y., Buffalo — Buerk Tool Wks., 38 Pearl St.—small internal grinder, Rivett type (used).

N. Y., Buffalo—A. B. Hunkele, 1599 Bailey Ave.—service station equipment, also one 1,000 gal. gasoline tank and pump.

N. Y., Buffalo—H. Sommers, 331 High St.—equipment, also one 1,000 gal. gasoline tank and pump for service station on Ellicott and Virginia Sts.

N. Y., Cape Vincent—L. L. Peo Garage Co. (garage and marine repair shop)—20 in. vertical drill and high speed twist drills.

N. Y., Carthage—Wilna Motor Sales Co., Inc. (garage and machine shop), F. L. Hatch, Purch. Agt.—internal grinder for cylinder work, Heald or similar.

N. Y., Endicott—W. O'Brien, 1204 Monroe St.—one portable electric drill.

N. Y., Henderson—Stevens Bros. Co., Main St., (garage, machine, motor and marine repair), M. Stevens, Purch. Agt.—slotter and metal saw up to 2½-3 in., motor drive.

N. Y., Jamestown—Eagle Garage Co., Inc., 316 Washington St.—garage, repair and machine shop equipment for proposed $50,000 addition to Ford garage and service station.

N. Y., New York—T. F. Jones, 374 West Bway. (brass signs)—one foot shears, 8 ft. long, for cutting brass and copper, also one table saw with tilting table.

N. Y., Redwood—E. W. Washburn Co. (machine shop and garage) — internal grinder and geared head turret lathe.

N. Y., Tonawanda—P. C. Rumbold, Clinton St. (garage)—14 in. back geared engine lathe (new or used).

N. Y., Watertown—Bat-Electric Service Co., 619 State St., (electric battery and machine work), W. W. Parsons, Purch. Agt.—20 in. vertical drill.

N. Y., Watertown—F. Empsall Co., Court St. (Radio Dept.)—10 or 12 in. engine lathe (new or used).

O., Columbus—Buckeye Wire & Iron Co., 1722 East Mound St., M. G. Rich, Mgr.—drill press, shears and weaving machine.

Pa., Allentown—C. R. Haned Oil Co.—machinery, tools and equipment for gasoline station on Liberty and St. Cloud Sts.

Pa., Erie—H. D. Gorman, 2631 Cochran St.—machinery, tools, equipment and tankage for large gasoline and service station on 26th St.

Pa., Erie—A. H. Murphy, 141 East 12th St.—machinery, tools and equipment for proposed addition to garage.

Pa., Erie—Mutual Telephone Co.—garage and plant equipment for proposed $400,000 building.

Pa., Lancaster—P. S. Devers, 228½ East Walnut St.—machine shop equipment, including lathes, grinders, etc.

Pa., Oil City—Fleckenstein Bros., Main St., P. Fleckenstein—machinery, tools and equipment for garage and repair shop on Relief St.

Pa., Phila.—Phila. Last & Pattern Co., 316 Cherry St.—bandsaw, boring machines, tenon machines, etc. for new factory.

Pa., Titusville—Oil Creek Refining Co. —machinery, tools, tankage and pumps for complete $35,000 gasoline and service station at Erie.

Tex., Gainesville—J. H. Maupin—power lathe for machine shop.

W. Va., Wheeling—Hazel-Atlas Glass Co., H. S. Brady, Pres.—equipment for 2 story machine shop.

Wis., Darlington—A. C. Poole—automobile repair machinery, including compressor, several ton press, belting, oil storage tanks and pumps.

Wis., Galesville—C. Klundred—automobile repair machinery, including small tools and compressor for proposed $40,000 garage.

Wis., Medford—C. Flemming—automobile repair machinery, press, gasoline storage tanks and pumps for proposed $40,000 garage.

Wis., Medford—Frendle Bros. Co., c/o H. Grann—automobile repair machinery, small tools, gasoline storage tanks and pumps for proposed $40,000 garage.

Wis., Merrill—H. H. Juul—automobile repair machinery, air compressor, gasoline storage tanks and pumps for proposed $40,000 garage.

Wis., Oconto—I. Telford—automobile repair machinery, including compressor, press, gasoline storage tanks and pumps for proposed $40,000 garage on Main St.

Wis., West Allis—Breithaupt Auto Exch., 393 51st St. (automobile service and repairs)—medium size drill press and grinder.

Que., Montreal—R. Frenette, 320 8th Ave. —complete equipment for garage and automobile repair shop.

Que., Montreal—I. Lewis, 804 Lewis Bldg., 17 St. John St.—power punch, medium size.

Que., Montreal—M. Meloche, 2218 Jeanne Mance St.—complete equipment for blacksmith and machine shop.

Machinery Wanted

Calif., Madera—The county, L. W. Cooper, County Clk.—receiving bids until May 8 for laundry equipment for hospital, including one 30 ft. line shaft, boxing, belting, pulleys, 24 in. extractor, one 30 x 30 in. and one 36 x 48 in. washer, 30 x 42 in. steam clothes tumbler, etc.

Del., Wilmington—Riodela Chemical Co., 1217 Lincoln St.—one Hance conical plate drug mill.

Ill., Centralia—G. Krug, 609 North Poplar St.—power job press and equipment.

Ill., Chicago—A. Finkl & Sons Co., 1326 Cortland St.—forge shop equipment, including one 30 ton overhead traveling crane.

Ill., Chicago — Natl. Salesmen Training Assn., 53 West Jackson St. (job printing dept.)—17 x 22 in. power paper cutter.

Ill., Chicago—New Era, 175 West Washington St.—intertype and linotype magazine.

Kan., Halstead—C. Barnes, Main St.—tinner's brake, shears, cutter and hand tools.

Kan., Wichita—Blunn Show Case & Cabinet Co., 828 West Douglas Ave., J. A. Blunn, Purch. Agt.—power sander.

Kan., Wichita—Chastiah Lumber Co., 115 Pattie St. (planing mill), A. Chastian, Purch. Agt.—Universal saw (used).

Kan., Wichita—East Side Sheet Metal Wks., 918 East Douglas Ave.—tinners' brake and tools.

Kan., Wichita—Steffen Ice & Ice Cream Co., 813 1st Natl. Bank Bldg., C. M. Beachy, Pres.—machinery for proposed ice cream plant.

Kan., Wichita—Wichita Refrigerator Mfg. Co., 567 West Douglas Ave.—power wood sander (used).

Ky., Louisville—Jefferson Co., Clk. of the Fiscal Court—one 32 in. bandsaw and combination woodworker with electric motor attached.

Ky., Whitesburg—Mountain Eagle—melting pot, coal burner and single linotype machine.

Mass., Boston—New Method Die Co., 100 Sudbury St.—42 in. paper cutter, 500 lb. paper baler, 14 in. circular power saw, wire stitcher, wood borer, work benches, floor scales and miscellaneous small woodworking tools (used).

Mass., East Boston (Boston P. O.)—Atlantic Wks., 80 Border St. (ship repairs), P. Bertelsen, Mgr.—miscellaneous machinery and equipment, including cranes for installation of floating drydock.

Mass., East Cambridge (Boston P. O.)—Scully Co. (sand, gravel and cement dealers), C. Mahony, Genl. Mgr.—hoisting, conveying and similar miscellaneous machinery.

Mass., Hudson — Chairman of School Com.—woodworking tools, including saws, tables, benches, planer, matcher, lathe and small tools for vocational department of new high school.

Minn., Watertown—Watertown Creamery Co., F. A. Mattson, Secy.—churn, ripener, possibly ice machine for new creamery.

Mo., Kansas City—H. A. Fuller, 2328 Kensington Ave. (machine and cabinet shop)—power wood lathe.

Mo., St. Louis—Abramson & Resnick Printing Co., 1015 Franklin Ave., A. Abramson, Purch. Agt.—two hand job presses, 9 x 12 in. up; paper cutters (used).

Mo., Webb City—H. Knost (mine operator)—mill for crushing ore, also sledge tables, crushers, belting, hangers, pulleys, shafting and bearings.

Neb., Omaha—City Linotype Co., 12th and Harney Sts.—five linotype machines.

N. H., Portsmouth—Portsmouth Automobile Body Co., T. J. Boyan, Purch. Agt.—woodworking machinery, including saws, planers, moulders, matchers, sanders, belting, motors, benches, drills, etc.

N. Y., Buffalo—Cuff Packing & Provision Co., Inc., William and Newell Sts., J. J. Cuff, 745 William St., Purch. Agt.—packing house equipment.

N. Y., Buffalo—F. J. Niles, 162 North Park Ave.—equipment for the manufacture of candy for factory at 514 Elmwood Ave.

N. Y., Buffalo—G. D. Pierakos, 36 Triangle St.—equipment for the manufacture of candy.

N. Y., Buffalo—N. Quarles, 141 Clinton St.—equipment for bakery.

N. Y., Buffalo—C. D. Rores, 1392 Bway. —equipment for the manufacture of candy for proposed factory at 310 Elk St.

N. Y., Chaumont — Phelps Boat Co. (manufacturer of boats)—¼ x 4 in. bandsaw with frame.

N. Y., Clyde—E. J. Hooker & Co.—complete mechanical equipment for 20 ton ice making plant.

N. Y., Edwards—Northern Ore Co.—mining machinery, including hoisting equipment.

N. Y., Horseshoe—Big Trout Corp. (lumber), D. A. Lloyd, Purch. Agt.—6 in. heavy duty bandsaw with frame and table.

N. Y., Jamestown—New Ice & Coal Co., Clinton St.—ice manufacturing machinery and equipment for $25,000 plant.

N. Y., Limerick—B. E. Peck Co. (grinding mill)—about 220 ft. of 1 7/16 and 1 11/16 in. cold rolled shafting, tenoner and sanding machine.

N. Y., Lowville — Monteola Hardwood Mill, Inc.—double surface planer and mortiser.

N. Y., Mannsville—J. Muller Co. (dairy products)—2½ ton triple chain hoist with traveler and 150 ft. track.

N. Y., Mechanicsville—T. L. Luther (lumber and millwork)—double surface planer, Barnes or similar, also tenoner.

N. Y., Medina—New York Canners, Inc. —machinery and equipment for pea vining station at Silver Creek.

N. Y., Natural Bridge—Sanford Lewis Co. (blacksmith and grist mill)—150 ft. of 1 5/16 in. cold rolled shafting; castings for built in forge with electrically driven blower; power carborundum stone and stand.

N. Y., North Tonawanda—R. T. Jones Lumber Co.—loading equipment and machinery.

N. Y., Phila.—Klock Bros. Co., Main St. (machine shop and garage)—castings for built in forge blower, motor drive; air compressor up to 185 lb. with tank; pattern makers bandsaw (new or used).

N. Y., Spring Valley—Bd. Educ.—complete vocational equipment for $250,000 school.

N. Y., Utica—H. A. Seick, 222 Lafayette St.—ice manufacturing machinery and equipment.

N. Y., Westfield—Westfield Lumber & Coal Co., T. Mosher, Mgr.—lumber mill machinery and equipment, to replace that which was destroyed by fire.

N. C., Cooleemee — Cooleemee Ice & Laundry Co.—ice manufacturing equipment.

N. C., Elizabeth City—Interstate Cooperage Co.—sawmill machinery and equipment, to replace that which was destroyed by fire.

O., Chillicothe—Buckeye Tile Co.—equipment for the manufacture of floor tiling.

Okla., Hastings—Printer, Box 88—Complete newspaper equipment, including press, belting, hangers and pulleys.

Pa., Allentown—Unger Bros., 13th and Green Sts.—dairy machinery and equipment.

Pa., Coudersport — Galeton Tannery — leech house and tanning machinery and equipment for $100,000 plant, to replace that which was destroyed by fire.

Pa., Erie—Consolidated Co.—machinery and equipment for printing plant, to replace that which was destroyed by fire.

Pa., Erie—Keystone Fish Co., Lake Front —machinery and equipment, including conveying machinery for proposed fish plant.

Pa., Franklin — Franklin Steel Wks. — machinery and equipment for 1 story, 45 x 425 ft. addition to steel mill.

Pa., Lancaster—E. Fraim Lock Co., Park Ave., S. E. Fraim, Genl. Mgr.—equipment for 1 story, 42 x 170 ft. foundry.

Pa., Lewiston—Lewiston Ice & Cold Storage Co.—additional ice manufacturing machinery and equipment.

Pa., Phila.—Barnes & Mayer, 3906 Powelton Ave. (manufacturer of paper boxes), A. Barnes, Purch. Agt.—paper box ruling machine.

Pa., Phila. — Collins & Aikman, 4675 Nixon St. (manufacturer of textiles), E. L. McKellar, Purch. Agt.—additional looms for new factory.

Pa., Phila.—H. Goldthorp Co., Jasper and Orleans Sts. (manufacturer of textiles)—Marron looms, belting, pulleys, etc., for new mill.

Pa., Phila.—Hardwick & Megee, Lehigh Ave. and Marshall St. (manufacturer of carpet), J. Kendig, Purch. Agt.—additional broad and narrow looms, belting, shafting and pulleys.

Pa., Phila.—Pennsylvania R. R., Broad St. Sta., S. Porcher, Genl. Purch. Agt.—two 250 ton and four 50 ton electric cranes for proposed machine shop at Altoona.

Pa., Phila.—R. C. Remmey & Sons, Delaware Ave. and Headley St. (manufacturers of brick)—conveyors, grinders and mixers for new plant.

Pa., Pittsburgh—Pittsburgh Transformer Co., Columbus and Preble Aves. (electrical supplies)—two 2 ton electric traveling cranes.

Pa., Reading — Chantrell Hardware & Tool Co.—equipment for foundry at Millmont.

Pa., Scranton — Luzerne Silk Throwing Co., 532 Scranton Life Bldg.—copping machines (new and used).

S. C., Timmonsville—A. Anderson—machinery and equipment for $35,000 hardwood veneer products mill.

Tenn., Nashville—Bon Air Chemical Co., Inc., c/o M. P. O'Connor, Stahlman Bldg.—complete chemical plant machinery and equipment.

Tenn., Pulaski—Uniontown Coal Co., c/o J. H. Ragsdale—machinery and equipment for development of coal properties.

Tex., Waco—Methodist Home Press (newspaper and job printing)—power paper cutter.

Va., Amherst—Amherst Co. School Bd.—vocational equipment for $90,000 school.

W. Va., Fairmont—Dixie Co.—machinery and equipment for proposed oil refinery.

W. Va., Fairmont — Marker Chemical Co., Inc., c/o R. L. Long—machinery and equipment for the manufacture of chemical fertilizers.

Wis., Green Bay—Reimer Bros. Co., 1372 Main St., A. Reimer, Purch. Agt.—refrigeration and grinding machinery, slicing machines, etc. for proposed sausage factory at Oshkosh.

Wis., La Crosse—A. J. Rasmussen, 1127 Main St.—heavy stone crushing machinery.

Wis., Madison—J. R. and E. J. Law, Archts., 1st Central Bldg.—refrigeration machinery, dish washing machinery, etc., for proposed Masonic Temple.

Wis., Madison—R. A. Phillips, 315 Beaver Bldg.—about 20 ton ice machine.

Wis., Madison—G. Wiesse, 111 King St. —special machinery, wrappers, etc., for proposed $40,000 cigar factory.

Wis., Milwaukee—J. Hack, 1055 18th St. (sheet metal)—one 10 ft. brake.

Wis., Milwaukee — Janesville Sand & Gravel Co., 47 North Ave.—one unloading crane.

Wis., Milwaukee—Milwaukee Journal Co., 182 4th St.—additional printing plant equipment, including presses.

Wis., Milwaukee—Reinhold Bros., 2402 Lisbon Ave. (sheet metal), R. Reinhold, Purch. Agt.—10 ft. brake.

Wis., Milwaukee—C. A. Rodemann, 1925 Nash St. (carpenter and millwork) — medium size shaper and sticker, about 3 in.

Wis., Milwaukee—F. Rossow, 1090 17th St. (bakery)—mechanical oven, motor driven sifters and mixers.

Wis., Milwaukee — School Bd., Supply Dept., 10th and Prairie Sts., F. M. Harbach, Secy.—one 2 spindle shaper for woodworking department.

Wis., Shawano—J. Popp—air compressor, gasoline storage tank and pump for proposed addition to garage.

Wis., Wausau—Tomahawk Craft Paper Co., c/o Wausau Sulphite Fibre Co.—special pulp grinding machinery for proposed sulphite pulp mill at Tomahawk.

Wis., Wauwatosa — Liberty Fdry. Co., 57th and State Sts.—foundry equipment, including cupola.

Wis., Wild Rose—E. Owens—machinery for cheese and butter factory, including power churns, bottle testers, cheese lifts, belting and shafting.

Ont., London—H. J. Jones & Sons, Dundas St., East (lithographers)—complete equipment for box factory, to replace that which was destroyed by fire.

Que., Granby — Granby Clay Products, Ltd., A. Lebelle, Purch. Agt.—brick pallets, cars, barrows, etc.

Metal Working Shops

Calif., Emeryville — The Detroit Steel Products Co., 251 Kearny St., San Francisco, awarded the contract for the construction of a 1 story, 110 x 120 ft. factory and warehouse near 64th and Boyle Sts., here. Cost will exceed $40,000. Noted Apr. 5.

Calif., Long Beach—The Milton Realty Co., 114 Locust Ave., Los Angeles, representing owners, is having plans prepared for the construction of a 5 story, 150 x 150 ft. garage on Atlantic St., here. Curlett & Beelman, Union Bank Bldg., Los Angeles, Archts.

Calif., Los Angeles—The Union Pacific R.R., 15th and Dodge Sts., Omaha, Neb., awarded the contract for the construction of a round house, engine house, freight car repair shops, locomotive and coach shops, yards, loading docks, etc., here. Cost between $1,500,000 and $1,750,000. Noted Jan. 11.

Calif., San Francisco—Greenberg & Sons, 225 Beale St., awarded the contract for the construction of a 2 story foundry on Folsom and Alice Sts. Estimated cost $20,000.

Calif., San Francisco—L. R. Lurie, 315 Montgomery St., is having plans prepared for the construction of a 1 story garage. Estimated cost $40,000. O'Brien Bros., Ins., c/o owner, Archts. Pacific Telephone & Telegraph Co., 333 Grant Ave., lessee.

Calif., San Francisco—E. Trevett, 408 Girard St., awarded the contract for the construction of a 1 story automobile repair shop on San Bruno Ave. near Silver Ave. Estimated cost $5,000.

Conn., Hartford—R. Piccola, 1137 Albany Ave., is having plans prepared for the construction of a 1 story, 40 x 60 ft. garage. Estimated cost $40,000. D. A. Guerriero, 1029 Main St., Archt.

Conn., Southington—The Beaton & Corbin Mfg. Co., Main and Chapman Sts., manufacturer of ceiling plates, plumbers supplies, etc., is having plans prepared for the construction of a 3 story, 40 x 72 ft. factory. Estimated cost $75,000. Private plans.

Conn., Southington — The Southington Hardware Co. has had plans prepared for the construction of a 2 story, 50 x 110 ft. hardware factory. Estimated cost $60,000. Private plans.

Conn., Waterbury—J. H. Cassidy, 144 Bank St., is having plans prepared for the construction of a 2 story, 50 x 60 ft. garage on Mitchel Ave. Estimated cost $40,000. H. F. Wenzel, 6 Glen Ridge St., Waterbury, Archt.

Conn., Waterbury—The Connecticut Brass Fdry., 600 East Main St., is having plans prepared for the construction of a 2 story, 30 x 40 ft. factory at 660 East Main St. Estimated cost $40,000. H. F. Wenzel, 6 Glen Ridge St., Waterbury, Archt.

Ill., Chicago—The Brunswick-Kroeschell Co., 460 West Erie St., manufacturer of ice machinery, is having plans prepared for the construction of a 1 and 2 story, 243 x 770 ft. factory at 4201-25 Diversey Ave. Estimated cost $375,000. Davidson & Weiss, 53 West Jackson St., Archts.

Ill., Chicago—The Harrington & King Perforating Co., 614 North Union Ave., manufacturer of mining screens, awarded the contract for the construction of a 1 story, 164 x 284 ft. factory at 5633-59 Fillmore St. Estimated cost $150,000. Noted Mar. 29.

Ill., Chicago—Loewenberg & Lowenberg, Archts., 111 West Monroe St., are receiving bids for the construction of a 1 and 2 story, 100 x 150 ft. automobile sales station and garage at 4822 North Clark St. for J. Schiffman, c/o Architect. Estimated cost $60,000.

Ill., Chicago—The Reo Motor Co., 2412 South Michigan Ave., awarded the contract for the construction of a 2 story, 85 x 125 ft. automobile sales and service station on Bway and Earle Sts. Estimated cost $100,000.

Ill., Chicago—M. J. Schmidt, c/o Rawson & Eisenberg, Archts., 5 North La Salle St., awarded the contract for the construction of a 1 story, 82 x 92 ft. automobile sales station and garage at 3327-31 West Madison St. Estimated cost $75,000.

Ky., Louisville—The Kentucky & Indiana Terminal R.R., 29th and High Sts., plans laying new switch tracks and enlarging shops and yards on 30th St. and Alford Ave. Estimated cost $2,000,000. W. S. Campbell, Ch. Engr.

Me., Portland—The Portland Nash Co. plans to build a 3 story garage. Estimated cost $100,000.

Mass., Lowell—The Saco Lowell Shops, Dutton St., manufacturers of textile machinery, are having plans prepared for the construction of a 3 story, 80 x 400 ft. manufacturing building and a 40 x 100 ft. forge shop with connecting bridges and service equipment. Lockwood, Greene & Co., Inc., 24 Federal St., Boston, Engrs. and Archts.

Mass., North Adams—The Mohawk Garage, 9 Main St., plans to build a 1 story addition to its garage. Estimated cost $45,000.

Mass., Pittsfield—S. Bridges, 46 Columbus Ave., awarded the contract for the construction of a 1 story, 120 x 150 ft. addition to garage. Estimated cost $40,000.

Mass., Pittsfield—B. K. George, 139 West Housatonic St., awarded the contract for the construction of a 2 story, 60 x 110 ft. garage on West St. Estimated cost $55,000. Noted Jan. 18.

Mass., Springfield—The Metallic Drawing Roll Co., c/o H. C. Spence, 111 Myrtle St., Indian Orchard, Pres., manufacturer of an appliance for cotton weaving machinery, plans to build a 1 story factory in the East Springfield Dist., here. Estimated cost $50,000.

Mich., Detroit—The Everhot Heater Co., 214 West Woodbridge St., is having plans prepared for the construction of a 1 story, 75 x 226 ft. factory for the manufacture of water heaters on Lafayette Blvd. Estimated cost $60,000. Dise & Titchy, 2631 Woodward Ave., Detroit, Archts.

Mich., Marquette—The Upper Michigan Motors Corp. awarded the contract for the construction of a two story, 80 x 100 ft. garage, battery service station and repair shop on Washington St. Estimated cost $60,000.

Mo., Monett—The St. Louis-San Francisco Ry. Co., Frisco Bldg., St. Louis, has had plans prepared for the rebuilding of a 15 stall roundhouse, repair shops, etc., which were recently destroyed by fire, here. Estimated cost $500,000. R. C. Stephens, c/o owner, Archt.

Mo., St. Louis—The Roxanan Petroleum Co., Arcade Bldg., awarded the contract for the construction of a 1 and 2 story, 62 x 92 ft. garage and a 1 story, 14 x 20 ft. pump house on Audubon Ave. Estimated cost $40,000.

Mo., St. Louis—The United Rys. Co., 3969 Park Ave., will build a 1 story addition to its car shop. Estimated cost $50,000. R. Wells, Receiver.

N. J., Trenton—The Crescent Armored Wire Co., Taylor St., awarded the contract for the construction of a 1 story, 40 x 80 ft. addition to its factory. Estimated cost $6,000.

N. Y., Ballston Spa.—E. Balmuth, Washington and Spring Sts., plans to build a machine shop and garage. Cost between $12,000 and $15,000.

N. Y., Binghamton—W. D. Sweet, 140 Chapin St. plans to rebuild garage and service station, which was recently destroyed by fire. Estimated cost $45,000. Engineer or architect not announced.

N. Y., Brooklyn—The Marke Storage Battery Co., c/o M. Morris & Sons, Engrs. and Archts., 533 Nostrand Ave., will soon receive bids for the construction of a 2 story, 70 x 100 ft. factory on Atlantic Ave. near New York Ave. Estimated cost $50,000.

N. Y., Cohoes—The Cohoes Motor Car Co., 42 Oneida St., plans to build a machine shop and garage on Ontario St. Cost between $60,000 and $65,000. W. Perkins, Pres.

N. Y., Elmira Heights (Elmira P. O.)—The Amer. Bridge Co., Frick Bldg., Pittsburgh, Pa., is having revised plans prepared for the construction of a 1 story, 50 x 210 ft. template shop, here. Private plans. Noted Mar. 8.

N. Y., Jamestown—The Eagle Garage Co., Inc., 316 Washington St., plans to build a 2 story addition to its Ford garage and service station on 10th and Washington Sts. Estimated cost $50,000. Engineer or architect not announced.

N. Y., Malone—H. S. Day, East Main St., plans to build a 40 x 80 ft. service station.

N. Y., New York—L. H. Willard, c/o J. J. Dunnigan, Engr. and Archt., 394 East 150th St., will build a 2 story, 115 x 330 ft. garage on McClellon St. Estimated cost $100,000.

N. Y., Schenectady—The General Electric Co., River Rd., awarded the contract for the construction of a 1 story, 46 x 428 ft. addition to Building 60; a 1 story, 120 x 203 ft. addition to Building 109; a 100 x 850 ft. addition to Building 85. Estimated cost $70,000, $52,000 and $250,000, respectively.

N. Y., Utica—The Schiller Electric Co., 1402 Francis St., plans to build an office, machine and repair shop on Genesee and Warren Sts. Estimated cost $65,000.

N. Y., Watertown—The Northern New York Utilities Co., Light and Power Bldg., will build a 2 story garage and machine shop on Front St. Estimated cost $40,000. S. D. Gilbert, Mgr. Noted Apr. 12.

N. Y., Watertown—The Otis Steam Boiler Co., c/o J. F. Otis, 335 West 1st St., Oswego, plans to build a 1 story boiler factory, here. Estimated cost $40,000.

O., Cleveland—The Armature Coil Equipment Co., c/o A. J. Fathauer, 3202 Scranton Rd., has had plans prepared for the construction of a 1 story, 40 x 113 ft. factory at 2411 Forestdale Ave. Estimated cost $40,000. Private plans.

O., Cleveland—A. Greenwald, Society for Savings Bldg., awarded the contract for the construction of a 2 story, 66 x 220 ft. bank, commercial building and garage on Bway and East 71st St. Estimated cost $150,000.

O., Cleveland—J. C. Kearns, c/o T. Cerny, Archt., 4025 East 52nd St., has had plans prepared for the construction of a 1 story, 40 x 65 ft. garage on West 11th St. and Clark Ave. Estimated cost $40,000.

O., Cleveland—J. J. Klein and G. B. Harris, Engineer Bldg., are having plans prepared for the construction of 2 story, 75 x 100 ft. and 80 x 110 ft. additions to automobile sales and service station at 6604 Euclid Ave. Estimated cost $125,000. W. S. Longee, 500 Marshall Bldg., Cleveland, Archt.

O., Cleveland—H. F. Neighbors, 1156 Hanna Bldg., awarded the contract for the construction of a 1 story garage and service building on East 23rd St. near Chester Ave. Estimated cost $50,000.

O., Cleveland—The Sands Mfg. Co., 5307 Sweeney Ave., manufacturer of water heaters, awarded the contract for the construction of a 2 story, 85 x 91 ft. addition to its factory at 5407 Sweeney Ave. Estimated cost $60,000. L. Sands, Pres.

O., Cleveland—The West Third-St. Clair Co., c/o A. N. Ferguson, Archt., 12821 Phillips Ave., awarded the contract for remodeling its 4 story garage at 1261 West 3rd St. Estimated cost $75,000.

Okla., Oklahoma City—A. C. Bennett, Criterion Theater, awarded the contract for the construction of a 2 story, 100 x 140 ft. building, containing sales, parts, accessories and used car display rooms, also repair shop, on 5th and Robinson Sts. Estimated cost $150,000. Meyers Motor Co., agents for Dodge Bros. cars, lessee.

Pa., Altoona—The Pennsylvania R. R., Broad St. Sta., Phila., awarded the contract for the construction of a 1 story, 340 x 690 ft. machine shop, here. Estimated cost $200,000.

Pa., Jeannette—The Pittsburgh Eng. Co. will build 1 story additions to its plant, consisting of an 80 x 200 ft. malleable foundry, an 80 x 150 ft. store house and a 60 x 80 ft. core room. Estimated cost $50,000. Noted Apr. 12.

Pa., Manyunk (Phila. P. O.)—The Robinson Iron & Steel Co. awarded the contract for the construction of a 1 story, 60 x 200 ft. foundry on Wheatsheaf Lane and Sepevia St. Estimated cost $25,000.

Pa., Pittsburgh—C. G. Hussey & Co., 2850 2nd Ave., are having plans prepared for the construction of a 3 story 80 x 200 ft. brass factory. Estimated cost $250,000. Private plans.

Pa., Uniontown—The Uniontown Automobile Co. awarded the contract for the construction of a 2 story, 41 x 70 ft. garage. Estimated cost $50,000. Noted Apr. 5.

Tex., Dallas—F. J. Woerner, Engr. and Archt., Sumpter Bldg., will receive bids the latter part of month for the construction of a 1 story, 100 x 125 ft. garage and automobile paint shop on Commerce and Duncan Sts. for B. R. Sparks, Jr., 217 North Brighton St. Estimated cost $75,000. Darby Top & Painting Co., 1113 Camp St., lessee.

W. Va., Glenville—Hall, Smith & Hall awarded the contract for the construction of a 1 story, 66 x 110 ft. garage. Estimated cost $40,000.

Wis., Fox Lake—The Fox Lake Auto Co. is having plans prepared for the construction of a 1 story, 66 x 87 ft. garage. Estimated cost $40,000. Peacock & Frank, 445 Milwaukee St., Milwaukee, Archts.

Wis., Kiel—The Kiel Machine Co. is having plans prepared for the construction of a 1 story, 64 x 80 ft. machine shop. Estimated cost $25,000. W. F. Neumann, 114 Grand Ave., Milwaukee, Archt.

Wis., Merrill—Peterson & Juul, Lawson Bldg., are having plans prepared for remodeling and construction of a 2 story, 40 x 70 ft. addition to garage. Estimated cost $40,000. J. Bauman, Genesee St., Merrill, Archt.

Wis., Milwaukee—C. Thomsen, 237 Cambridge Ave., awarded the contract for the construction of a 1 story, 50 x 78 ft., garage on Farwell Ave. Estimated cost $40,000.

Wis., Oconto—I. Telford plans to build a 2 story, 47 x 125 ft. garage and repair shop on Main St. Estimated cost $40,000. Engineer and architect not selected.

Wis., South Milwaukee—The Bucyrus Co., manufacturer of steam dredges, is having preliminary plans prepared for the construction of 1 and 2 story additions to its plant, including foundry. F. D. Chase, Inc., 645 North Michigan Ave., Chicago, Engr.

Wis., Waukesha—The Quality Aluminum Co., c/o A. C. Pankratz, 505 Lake Ave., is having preliminary plans prepared for the construction of a 1 story, 85 x 200 ft. foundry. Estimated cost $50,000. Federal Bridge & Structural Co., Waukesha, Archts.

Wis., West Allis — Hunt & Grassold, Engrs. and Archts., 445 Milwaukee St., Milwaukee, are receiving bids for the construction of a 2 story, 60 x 87 ft. garage on 53rd Ave., for the Burbach Auto Service Co., 5225 Greenfield Ave., here. Estimated cost $40,000. Noted Jan. 25.

This is NOT the end—

You will find the latest Business Opportunities in the machinery field published in the

SEARCHLIGHT SECTION

of this issue

It will pay you to watch the announcements printed here each week.

Turn Now To pages 125 to 138.